THE DEVELOPMENT AND STANDARDIZATION OF A MAP READING TEST FOR GRADE NINE STUDENTS IN THE PROVINCE OF NEWFOUNDLAND AND LABRADOR

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BY

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ABSTRACT

The purpose of this study was to develop and standardize a map reading test that could be used to assess the attainment of beginning grade nine students. The review of research and related literature pertaining to map skills indicated a need for assessment instruments to be relevant to local and regional skills objectives.

Consequently, this researcher focused on the development of a test which assessed twenty-eight skill statements which had been formulated on the basis of a study of the curriculum guides and textbooks currently used in the social studies programs in the province of Newfoundland. The test attempted to assess student's ability in the use of direction, elevation, location, scale, grid systems and map interpretation.

The following of test development procedures resulted in the creation of a revised form of the test based on suggestions from a professional cartographer, a testing expert, geography teachers, a social studies specialist and data obtained in trial testing of the instrument.

Using a cluster sampling technique, the revised instrument was administered to two hundred twenty grade nine students in ten schools across nine different school boards in the province of Newfoundland.

The analysis of test results involved computing mean percentage scores of all students in each skill area. On the test as a whole, the students' mean percentage score was sixty-six percent. A Kuder-Richardson 20 reliability coefficient of .89 was obtained for the test. Norms for the test were developed by transforming raw scores to T scores and percentile ranks.

The limitations of the study were discussed. Also, a number of suggestions for further research were presented.

On the basis of the findings of the study, it was concluded that an instrument for assessing the map reading skills of beginning grade nine students had been developed that (a) was valid and reliable; (b) could be used to diagnose students' skill deficiencies; and (c) permitted comparison of students' performance with established norms.

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DEDICATION

This thesis is dedicated to thee

who are yet to be.

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CHAPTER ONE

THE PROBLEM

Background

Skills are growing in importance in a world where scientific knowledge may be said to be increasing extremely rapidly. What skills, then, should the social studies curriculum be developing in students? This is a difficult question for a number of reasons. At different times different emphases have been placed on various social studies skills. The emphasis on skills of a particular type may also change due to local curriculum priorities.

Map skills have had in the past and still have an important role to play today in the social studies curriculum. Generally, it is accepted that by the time school children have completed the elementary grades, most of them should be able to read maps accurately and easily. Upon completion of junior high school, students should be proficient in the use of many skills that would permit them to avail of any map's fund of information.

There are differences among educators about what specific skills should be taught, and when and how they should be taught, but most educators have a common interest in the extent to which pupils are progressing in their attainment of desired levels in specific map reading skills at various grade and age levels.

The evaluation of pupil progress is a major aspect of the educational process. A clear picture of where a student is at present and of how he is progressing is a fundamental consideration for effective teaching on behalf of the teacher and effective learning on behalf of the pupil. Kurfman and Solomon make the point well when they state:

> Education is a continuous process of growth. Measurement is the means of obtaining the information necessary to improve this process--to see what has been accomplished and to find out what needs to be done to insure the growth that is desired.[1]

For the social studies teacher who is interested in the development of map reading skills among his students, it is necessary that he know: (a) the extent to which the instructional techniques and materials used have been successful in aiding students to achieve the program objectives relating to map reading, (b) the extent to which individual students and classes as a whole have attained a satisfactory level of competence in desired skills, and (c) the relative strengths and weaknesses of his students in the various skill areas. Evaluation is the means for achieving these ends.

If evaluation is to be as effective as possible, there should be a direct relationship between the assessed objectives

[1]D. Kurfman and R. Solomon, "Measurement of Growth in Skills", in Skill Development in the Social Studies, ed. H. M. Carpenter, Thirty-third Yearbook of the National Council for the Social Studies (Washington, D.C.: The Council, 1963), p. 274.

of any specific achievement test and the major goals or aims of the course of study under examination. One of the best ways to accomplish this task is to use teacher-made tests which, according to Thorndike and Hagen, are "based on content and objectives specific to a teacher's own class or school."[2]

Another important source of information is standardized tests. It is in this area perhaps that most criticism of tests has been levelled. Thorndike and Hagen view standardized tests as being particularly valuable in two kinds of situations: those in which comparisons need to be made, and those in which there are a large number of people about whom decisions need to be made, but for whom the decision maker has no common or comparable data.[3] In the subsequent discussion of the benefits and limitations of standardized tests, Thorndike and Hagen conclude:

> When used with discretion and proper reservations, standardized achievement tests can serve a useful purpose as one type of evidence: (1) to diagnose learning difficulties; (2) to appraise gains in achievement of groups; (3) to counsel parents and students; (4) to group students for instruction; (5) to plan instructional activities; and (6) to evaluate the curriculum.[4]

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[2]R. L. Thorndike and E. Hagen, Measurement and Evaluation in Psychology and Education (3rd ed.; New York: John Wiley and Sons, Inc., 1969), p. 258.

[3]Ibid., p. 259.

[4]Ibid., p. 289.

In summary, it must be noted that the collection of information pertaining to the attainment of skills depends upon the construction of instruments that adequately sample relevant skills. It is essential that relevant and reliable measures of skill levels be available to the educator so they can be used to provide data for rational decision making.

Statement of the Problem

The problem addressed by this study is to develop an instrument for the assessment of map reading skills possessed by grade nine students in the Province of Newfoundland. The instrument was developed for use on a provincial basis. The objectives assessed by the test are based on the social studies program as outlined in the texts and curriculum guides of that province.

Need for Resolution

Over the years there has been concern expressed about the lack of time and emphasis devoted to geography in the schools. Writers such as Hudman[5] and Ball, et al.,[6] have expressed the view that basic geographic skills and concepts have not been sufficiently emphasized by teachers of social

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[5] L. E. Hudman, "Geographic Concepts: A Need to be Explicit", Journal of Geography, 71 (December, 1972) pp. 520-525.

[6] J. M. Ball, J. E. Steinbrink, and J. P. Stoltman, eds., The Social Sciences and Geographic Education: A Reader (Toronto: John Wiley and Sons, Inc., 1971), pp. 90-100.

studies. Factual material, according to these authors, has received too much attention and one of the most important aspects of learning geography, that of using skills in a way similar to the geographer, tends to be played down. Students, therefore, are handicapped when attempting to analyze and interpret geographic information because they do not possess a sufficiently well-developed set of skills to deal efficiently with the material presented to them.

Moore and Owen effectively state a rationale for inclusion of the study of maps in the social studies program of a school.

> The justification, then, for a map work program in schools is a strong one. The child has a lively curiosity in the things around him; the teacher has an opportunity to make classroom teaching more meaningful; the structure of geography can be demonstrated; the social utility of map work adds to its inclusion in a curriculum of study. . . .[7]

The literature regarding map reading includes many listings of separate skills involving all of the functions a map can perform. There have been many proposed sequences

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[7]E. Moore and E. E. Owen, Teaching the Subjects in the Social Studies (Toronto: The Macmillan Company of Canada, Ltd., 1966), p. 116.

of skills: Rushdoony,[8] Kennamer,[9] Joyce and Alleman-Brooks,[10] Askov and Kamm,[11] Michaelis.[12] One must be aware, however, that each skill in a map reading sequence chart has a developmental aspect; therefore, any sequence can only give a general grade placement. The placements are merely tentative suggestions because the success of any sequential map skills program depends upon the child's maturity level, individual differences, and his set of past experiences.

Maps can be very powerful instruments. They have the potential to be an extremely influential means of communicating geographic information in a very compact and concise form. To the students in the schools, maps can function as essential tools for learning. In order to avail of a map's potential usefulness, however, the student must be capable

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[8] H. A. Rushdoony, "A Child's Ability to Read Maps: Summary of the Research", Journal of Geography, 67 (April, 1968), pp. 213-222.

[9] L. Kennamer, "Developing a Sense of Place and Space", in Skill Development in the Social Studies, ed. H. M. Carpenter, Thirty-third Yearbook of the National Council for the Social Studies (Washington, D.C.: The Council, 1963), pp. 148-170.

[10] W. W. Joyce and J. E. Alleman-Brooks, Teaching Social Studies in the Elementary and Middle Schools (New York: Holt, Rinehart and Winston, 1979), pp. 134-137.

[11] E. N. Askov and K. Kamm, "Map Skills in the Elementary Schools", Elementary School Journal, 75 (December, 1974), pp. 112-121.

[12] J. U. Michaelis, Social Studies for Children in a Democracy (5th ed.; Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1972), pp. 527-534.

of reading, interpreting, and using a map's fund of information. It is essential, then, that the student be systematically taught those necessary map skills which are within his level of comprehension. It is equally important that evaluation of student skills be carried out by teachers. Reliable and valid measures of the objectives of the social studies skills program for any province, state, or school district are essential. By careful study of the content of textbooks used in the geography courses and of curriculum guides published by the Newfoundland Department of Education, tests relevant to the objectives of the program of that province can be developed.

Test Inadequacies

Although some standardized test batteries such as the Stanford Achievement Test[13] and the Canadian Tests of Basic Skills[14] include a number of items testing specific map skills, tests which are developed for use on a national basis tend to be of somewhat limited use to classroom teachers on a more regional basis. Thus, because of the variations from community to community no published test can be made to fit precisely the objectives and the content of

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[13] Stanford Achievement Test (New York: Harcourt Brace Jovanovich, Inc., 1972).

[14] Canadian Tests of Basic Skills (Toronto: Thomas Nelson and Sons (Canada), Ltd., 1976).

every local course of study. As Thorndike and Hagen iterate:

> In this sense, a test developed on a national basis is always less valid for a specific community than an equally workmanlike test tailored specifically to the local situation.[15]

An attempt to meet the challenge as stated above was undertaken by R. Pack.[16] He developed a valid assessment instrument based on the geography tests and geography curriculum program as outlined in the curriculum guides for grade four Newfoundland students. Pack developed a test which attempted to assess student attainment in determining direction, scale, location, and evaluation on maps, reading a grid map, reading horizontal and vertical graphs, and interpreting information from maps and diagrams. Pack chose a sample and administered his test. The results indicated that the students' level of attainment was below the 80 percent level in all skill areas with the exception of reading a grid map.

In 1974 the Newfoundland and Labrador Department of Education instituted a standardized testing program; each year one grade level is being tested--grade four, six, or eight--using the Canadian Tests of Basic Skills.

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[15] R. L. Thorndike and E. Hagen, Measurement and Evaluation in Psychology and Education (3rd ed.; New York: John Wiley and Sons, Inc., 1969), p. 165.

[16] R. Pack, "An Assessment of Selected Geographic Skills Attained by Grade Five Students in Newfoundland," (Master's thesis, Memorial University of Newfoundland, 1979).

Recognition of the great need for close coordination between curriculum program objectives and standardized test items was noted by the testing specialist at the Department of Education when he revealed in the report Standards Testing Program 1981 Final Report:

> While there may indeed be some lack of relevance to particular local instructional objectives, norm referenced tests may be modified to more closely fit local instructional programs. Although modifications of this type are rarely made, such a possibility does exist.[17]

The lack of high achievement by many of the students in Pack's study[18] is indicative of a need for added emphasis on these skills in the social studies curriculum. The need for modification of standardized tests developed on a national basis is also recognized. Arising out of these two considerations it was decided as valuable by this researcher to assess the map reading abilities of Newfoundland students while attending junior school. Instead of carrying out a one-shot assessment, it was felt by this researcher that an instrument which could be used repeatedly by different administrators would be of some value. The provision of norms for the test would also facilitate group comparisons.

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[17] Division of Instruction, Standards Testing Program 1981 Final Report (St. John's, Newfoundland: Department of Education, 1982).

[18] R. Pack, "An Assessment of Selected Geographic Skills Attained by Grade Five Students in Newfoundland," (Master's thesis, Memorial University of Newfoundland, 1979).

SOCIAL SCIENCE DISCIPLINES

There are many aspects of the present world that are of immediate concern to the social studies. Transportation and communication improvements have meant drastic increases in the speed at which people, goods, and information may be moved from one place to another. The world, therefore, appears to be expanding in terms of people's exposure to things beyond their immediate environment. The ability of individuals to cope adequately with such massive inputs of information would be greatly facilitated if both students and adults had an ability to read and interpret maps of many various types.

For educational purposes of study and research, skill in map reading and interpretation would certainly enhance the ability of students to acquire information relevant to their studies. The use of maps is not confined to one particular subject area; that maps can make significant contributions to various areas of the school curriculum will be discussed next.

A map may be thought of as a device which may be used for the organization and communication of information in visual form. It generally presents such information in a compact format, but may have to utilize somewhat abstract symbols to do so.

> A map is much more than a mere reduction, however. If well made, it is a carefully designed instrument for recording, calculating,

> displaying, analyzing and, in general, understanding the interrelation of things in their spatial relationship. Nevertheless, its most fundamental function is to bring things into view.[19]

The process of revealing information about the pattern of development of the earth may be defined basically in three phases:

> The surveyor measures the land, the cartographer collects the measurements and renders them on a map, and the geographer interprets the facts thus displayed.[20]

The purpose of cartography as a field, then, is stated by Raisz to be:

> . . . to collect and analyze data and measurements of the various patterns of the earth and to represent them graphically on such a reduced scale that the elements of the pattern can be made clearly visible. For revealing the earth's pattern the chief instrument of the cartographer is a map.[21]

Thus, the map may be considered to be of paramount importance to the cartographer in the carrying out of his tasks.

The use of maps must not be assumed to be limited to the use of the cartographer. For the geographer,

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[19] A. H. Robinson and R. D. Sale, Elements of Cartography (New York: John Wiley and Sons, Inc., 1969), p. 2.

[20] E. Raisz, General Cartography (New York: McGraw-Hill Book Company, Inc., 1948), p. xi.

[21] Ibid.

> . . . the map serves as a tool, certainly the paramount tool of the profession. Every geographer must have a working knowledge of cartographic presentation, not only to read maps but also to make them.[22]

The centrality of maps to the work of the geographer is further emphasized by Moore and Owen when they state:

> The map is the geographer's basic tool on which he records his ideas and from which he interprets, according to his point of view, the varied phenomena existing together in a particular place. For him, map making, map reading, and map interpretation are fundamental skills.[23]

As further outlined by Kennamer, the map acts as an effective tool for the geographer whose uses of it may include the following: (a) as a base for recording observed data, (b) for clarification of relationships between phenomena, (c) for comparisons of distributions both within and between areas, and (d) as a communications device to present spatial relationships.[24]

It is not only among professional geographers, however, that an extensive use of maps is employed. Because of the efficient manner in which maps can convey information, many

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[22] J. O. M. Broek, Geography, Its Scope and Spirit (Columbus, Ohio: Charles E. Merrill Publishing Company, 1965), p. 64.

[23] E. Moore and E. E. Owen, Teaching the Subjects in the Social Studies (Toronto: The Macmillan Company of Canada, Ltd., 1966), p. 115.

[24] L. Kennamer, "Developing a Sense of Place and Space", in Skill Development in the Social Studies, ed. H. M. Carpenter, Thirty-third Yearbook of the National Council for the Social Studies (Washington, D.C.: The Council, 1963), p. 149.

scientists and scholars use maps for the formulation of hypotheses, the analysis of data, and the eventual communication of their findings. Therefore, during the course of research, frequent use of maps may be made by such scientists as climatologists, oceanographers, geologists, and zoologists.

Although maps may be encountered in many subjects taught in the curriculum, the map is perhaps most frequently used in the subject of geography. This point is made by Douglass when he writes.

> The map is <u>the</u> unique tool of geographic study, of course, not only because it provides a valuable source of information but because of its central importance in recording and analyzing the data.[25]

Thus, in the study of geography the student is involved in utilizing various methods of communication other than the written form of the word. The map is one such example: charts, graphs, pictures, and models are others.

There are certain skills and techniques that are essential to both the teaching and the learning of geography. Some of the techniques that students use in learning geography are similar to those that would be used in learning the physical sciences or other social studies. Teachers do, however, have a tendency to associate certain learning tools more closely

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[25] M. P. Douglass, <u>Social Studies: From Theory to Practice in Elementary Education</u> (New York: J. B. Lippincott Company, 1967), p. 254.

with geography than with the other subjects. Therefore, as Stimson notes:

> The techniques of reading globes, maps, atlases, profiles, cross sections and weather instruments are usually developed in the study of geography.[26]

The map is often considered to be an essential instrument used in the study of the social sciences, but its use is not confined to these areas either. The case for wide and varied use of maps is well made by Dunfee and Sagl when they write:

> Skill in reading and interpreting maps facilitates the answering of many questions that are the objects of children's research in many of the areas of learning.[27]

Maps, therefore, are encountered in other subjects as well, particularly history.

> The relationship between history and geography is so close that there should be a constant use of maps in the teaching of history . . . . In a study of exploration, discovery, and colonization, the information furnished by the map is almost as important as the facts of history. Maps, then, serve as an aid to put into concrete form certain important aspects of the study of human activity in the past.[28]

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[26] L. Stimson, "Geography", in The Social Sciences: Foundations of the Social Studies, eds., J. U. Michaelis and A. M. Johnston (Boston: Allyn and Bacon, Inc., 1965), p. 99.

[27] M. Dunfee and H. Sagl, Social Studies Through Problem Solving (New York: Holt, Rinehart and Winston, Inc., 1966), p. 242.

[28] A. C. Bining and D. H. Bining, Teaching the Social Studies in Secondary Schools (New York: McGraw-Hill Book Company, Inc., 1952), p. 262.

The other social sciences as well, such as sociology, anthropology, economics, and political science depend upon maps as an aid in the development of an understanding of people and their way of life. Less frequently maps may be encountered in the study of literature where they may be used to show the setting of stories, events occurring in the stories, or to indicate the paths of travel of characters involved in the action of the plot. Such maps may greatly increase the reader's perspective of the places where the action occurs, whether the places be real or imaginary. It may be concluded, then, that maps are used in many different subjects of the curriculum and the ability of students to read maps would greatly enhance their ability to visualize far away places, people, and events.

Maps are also important in aiding individuals to understand events outside of schools in the world around them. The ordinary citizen, if he is to be considered geographically literate, must possess map reading and interpreting skills. Students and adults gain an important amount of information from the maps in such sources as newspapers, periodicals, television, textbooks, and travel-route materials, e.g., road maps. Much of the information available to people can be communicated in an efficient, accurate, and economical manner only through the use of maps. The development of map reading skills must surely be awarded adequate time in the curriculum available to students in the schools.

The evaluation of map reading skills possessed by students is viewed by this researcher to be of primary importance in the process of social studies education.

PEDAGOGICAL THEORY

The point has been made that the process of discovering information and learning about one's environment can be greatly facilitated through the use of maps. In considering the map reading skills of children, the theoretical and empirical findings of genetic epistemology, child development, learning psychology, and curriculum and instruction theories have some bearing on this thesis. Several of the most notable authors whose work has some relevance for this study are J. Piaget, J. S. Bruner, R. Gagne, and H. Taba. Their work will be discussed in the following sections of this chapter.

Cognitive Development

Piagetian Theory

Jean Piaget referred to himself as a genetic epistemologist. What exactly does that mean? Piaget himself provided a brief explanation of genetic epistemology when he stated:

> Genetic epistemology deals with the formation and meaning of knowledge and with the means by which the human mind goes from a lower level of knowledge to one that is judged to be higher. It is not for psychologists to decide what knowledge

> is higher or lower, but rather to explain how the transition is made from one to the other. The nature of these transitions is a factual matter. They are historical, or psychological, or sometimes even biological.[29]

In short, then, genetic epistemology "attempts to explain knowledge".[30]

According to Piaget's theory of cognitive development, the human organism goes through processes of organizing experiences in order to adapt to its environment. The human organism's knowledge of the world, therefore, results from "a structuring of the relations between the environment and the organism".[31]

Piaget has revealed through his research four major developmental stages, each made up of numerous substages. These four stages and the approximate ages at which they occur in the cognitive development of children are as follows: (1) the sensori-motor stage (0-2 years); (2) the preoperational stage (2-7 years); (3) the concrete operational stage (7-11 years); (4) the formal operational stage (11-15 years).[32]

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[29] R. I. Evans, Piaget: The Man and His Ideas (New York: E. P. Dutton and Company, Inc., 1973), p. xiii.

[30] E. Duckworth, trans., Genetic Epistemology, by J. Piaget (New York: Columbia University Press, 1970), p. 1.

[31] M. Piercy and D. E. Berlyne, trans., The Psychology of Intelligence, by J. Piaget (Totowa, N.J.: Littlefield, Adams and Company, 1973), p. 5.

[32] B. J. Wadsworth, Piaget's Theory of Cognitive Development (New York: Longman, Inc., 1979), pp. 37-116.

The Sensori-Motor Stage extends from the beginning of life to approximately eighteen to twenty-four months of age. At birth the baby has innate reflexes only, sucking and grasping. During the early months of life the distinction between self and non-self is not realized, but towards the end of this stage of cognitive development, he finally regards himself as one object among many. The child starts to learn through interaction between himself and his environment. His actions of assimilation and accommodation commence. He learns that certain movements in certain directions carried out at certain times leads to certain results.[33]

Symbolic activity appears towards the end of this stage as evidenced by the child's use of words as symbols in his developing use of language. However, Piaget steadfastly holds that language acquisition is not a necessary condition for intelligence. This first sensori-motor stage is the foundation for the child's manifestation of intelligent behavior through overt behavior. This overt intelligent behavior subsequently becomes interiorized and the solutions to problems presented to the organism are worked out through mental covert actions.

The Preoperational Stage covers the child's life from approximately two years to seven years of age. This period

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[33] H. Rosen, Pathway to Piaget (Cherry Hill, New Jersey: Postgraduate International, Inc., 1977), p. 12.

is characterized by the development of the semiotic functions. These include language, but also such things as mental imagery. The child can now represent to himself an object when it is absent. Thus, a new level of intelligence is developed. Intelligence at this stage is representation and thought. It is no longer restricted to overt action. Whereas in the sensori-motor stage the child deals with the immediate space around it and with the present time, the preoperational stage sees the development of the child's ability to represent objects to himself and to think about objects that are far removed in space or events from the past or future.[34]

The Concrete Operational Stage starts at about seven and continues until about eleven years of age. It is during this stage that logical thought arises. Logical thought arises when the child has built up a stock of concrete concepts which he begins to manipulate into a system. Thus, the child can deal effectively with concepts that the preoperational child cannot. One such concept is seriation--the ordering in size in a systematic way. Another is classification, the inclusion of one class with another. There is at this stage, also, some conservation of length and weight. Conservation is the capacity to grasp the idea

[34] R. I. Evans, Jean Piaget: The Man and His Ideas (New York: E. P. Dutton and Company, Inc., 1973), p. 24.

that despite certain changes in an object, or set of objects, there are particular properties that remain unchanged.[35] There is a limitation in the stage of concrete operations, however, in that the operations of this period are called concrete because they apply to objects and not to verbal hypotheses.

The period of Formal Operations ranges approximately from the eleventh to the fifteenth year of age, and it is the final stage in the cognitive development of the human organism. Whereas operations of the concrete operational stage involve real objects, those of the formal operations go beyond the actual and the known object to employ "hypothetico-deductive reasoning'. Thus, Inhelder and Piaget observe that:

> The connection indicated by the words 'if . . . then' (inferential implication) links a required logical consequence to an assertion whose truth is merely a possibility.[36]

The main feature of this stage is that there is now the possibility of applying operations not only to objects, but to hypotheses formulated in words. The child is no longer deterred by his perception, nor limited to the concrete situation. He can consider a number of variables in turn. The child at this stage has mastered reversibility. The

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[35] H. Rosen, Pathway to Piaget (Cherry Hill, New Jersey: Postgraduate International, Inc., 1977), p. 20.

[36] A. Parsons and S. Milgram, trans., The Growth of Logical Thinking from Childhood to Adolescence, by J. Piaget (New York: Basic Books, 1958), p. 257.

child develops the ability to make representations and transformations which are completely internal with no direct correspondence to real objects and events. The child's thought is no longer tied to the present, past, and future. The child has thus reached the structure of the final equilibrium to which concrete operations tend.

The cognitive development of the child, according to Piaget, is influenced by four factors: (1) maturation, (2) physical experience, (3) social interaction, and (4) equilibrium.[37] The movement of the child from stage to stage of cognitive development results from the interactions of these factors. No single factor is sufficient to ensure cognitive development.

Piaget sees maturation as placing some broad limits within which the cognitive development of the child will proceed at each stage. Realization of the possibilities available to the child will be dependent largely on the child's actions on and interactions with his environment. A key factor in cognitive development, then, is the opportunity available for the child to act on objects, especially during the sensori-motor stage. As the child develops and is capable of reasoning, his thoughts become one form of such

[37] J. Piaget, "The Genetic Approach to the Psychology of Thought", Journal of Educational Psychology, 52 (December, 1961), pp. 275-281.

"action" on objects. The child acts through overt physical action or covert mental action in order to carry out the necessary assimilation and accommodation needed to reestablish the equilibrium which is upset by his exposure to stimuli in his environment.

For the purpose of discussing and outlining the cognitive growth of a human organism, Piaget has divided intellectual development into four broad stages which have been previously described. Piaget has been criticized for the use of such stages in his theory by those who seem to think that the child jumps from one discrete stage to the next. Piaget, however, holds that the cognitive development of an individual flows along on a continuum. The developing child moves through an orderly sequence in which one stage is, in logical order, prior to the next. The appearance of any operation is thus dependent on the stage of development. The behaviors described in any stage are only typical of a given age. The ages during which children can be expected to develop behavior representative of a particular stage are not fixed. The ages are only suggestive of times during which most children can be expected to have acquired the intellectual structure characteristic of a particular stage.[38]

[38] B. J. Wadsworth, Piaget's Theory of Cognitive Development (New York: Longman, Inc., 1979), pp. 28-31.

Piaget states:

> In a general way, the fact should be emphasized that the behavior patterns characteristic of the different stages do not succeed each other in a linear way (those of a given stage disappearing at the time when those of the following one take form), but in the manner of the layers of a pyramid (upright or upside down), the new behavior patterns simply being added to the old ones to complete, correct or combine with them.[39]

Thus, Piaget, while not contending that each stage must begin at a specific time, would certainly hold that each child must pass through the stages of cognitive development in the same order. A child cannot move intellectually from the preoperational stage to the period of formal operations without passing through the period of concrete operations.

In summary, then, from birth to adulthood, the structures of intelligence (the schema) are constantly developing as the child acts on his environment (by overt or covert behavior) and he thereby assimilates and accommodates to the variety of stimuli presented to him in his environment.

The relevance of Piaget's work to the present study will be discussed at the conclusion of the next section in conjunction with the work of Jerome S. Bruner.

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[39] M. Cook, trans., The Origins of Intelligence in Children, by J. Piaget (New York: International Universities Press, 1952), p. 329.

Brunerian Theory

Bruner has described three ways in which knowledge may be acquired: through actions, through pictures and images, and through symbolic means such as language.[40] These three modes of representation occur in a developmental sequence, but Bruner does not condone a rigid acceptance of the concept of stages. All levels may persist to some degree. "The symbolic level is possibly more powerful and economical, but the iconic, and even the enactive methods may be applied to a particularly thorny problem".[41] In solving a mathematical problem, for example, it may be useful to draw a diagram (iconic) or even construct a model (iconic and enactive).

Snelbecker has provided a summary of Bruner's conception of intellectual growth:

> (1) Intellectual growth involves increasing independence from the direct eliciting influence of stimuli through the development of cognitive mediating processes which enable one to deal with stimuli on a symbolic level.
> (2) Thus growth involves development and refinement of one's internal system for representing objects and events.
> (3) It also involves increasing ability to use words and symbols to logically analyse what we have done and can do in the future.

[40] J. S. Bruner, "The Course of Cognitive Growth", American Psychologist, 19 (January, 1964), p. 2.

[41] M. J. Adler, "Some Educational Implications of the Theories of Jean Piaget and J. S. Bruner", Canadian Education and Research Digest, 5 (March, 1965), p. 8.

(4) This intellectual growth is fostered by systematic and exploratory tutor-tutee relationships with various significant persons serving as tutor.

(5) Language constitutes a tool and instrument which enables the learner to comprehend order in his environment as well as constitutes a means which facilitates learning.

(6) With intellectual growth we become capable of engaging in more than one transaction at one time and to allocate our intellectual resources wisely in coping with different stresses from our environment.[42]

Bruner considers the enactive and iconic modes to be the most primitive forms of representation which lead developmentally to the symbolic mode. The most specialized symbolic activity is language which provides a means not only for representing knowledge, but also for transforming it. Bruner makes the point that:

> . . . without special training in the symbolic representation of experience, the child grows to adulthood still depending in large measure on the enactive and iconic modes of representing and organizing the world, no matter what language he speaks.[43]

Thus, the child must be helped to pass from concrete thinking to the utilization of more symbolic modes of thought.

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[42] G. E. Snelbecker, Learning Theory, Instructional and Psychoeducational Design (New York: McGraw-Hill Book Company, 1974), p. 415.

[43] J. S. Bruner, R. R. Oliver, and P. M. Greenfield, Studies in Cognitive Growth (New York: John Wiley and Sons, 1966), p. 16.

What relevance do the theoretical positions suggested by Piaget and Bruner have for this present study? Most grade nine students would be expected to have passed through the first three stages of cognitive development as outlined by Piaget. Many students can be expected to have progressed well into the final stage of formal operations. According to Bruner, most grade nine students would be expected to have advanced to and be capable of effectively using the symbolic mode of representation. Provided the necessary instruction has taken place and experiences have been provided, students at this grade level should be cognitively capable of dealing effectively with such concepts as: latitude, longitude; north, east; symbols for roads, railroads, rivers; resource areas and elevation designated by various shading techniques; and linear and areal scale determination. Grade nine students, therefore, may be expected to be capable of using such map reading skills as: determining direction and elevation; using a scale and a grid system; locating places; and interpreting information from maps. Map intrepretation may be considered the most complex of the map reading skills because it may involve the use of not one single skill, but may instead require the integration of information and use of several map reading skills simultaneously.

Learning Psychology

Robert Gagne has made a significant contribution in the field of learning psychology.[44] This psychologist has been concerned with the goals of instruction--what is to be taught. He advises that the "capability" be stated specifically at the outset in behavioral terms. One can then analyze the task into its prerequisite capabilities, building a pyramid of capabilities toward the desired objective. Capability in all prerequisites implies that an individual is now ready for the next step.

Rejecting the view that there is one type of learning such as stimulus-response or problem solving, Gagne's analysis of capabilities has led him to categorize them in a hierarchy as follows:

Type 1 Signal Learning
Type 2 Stimulus Response Learning
Type 3 Chaining
Type 4 Verbal Association
Type 5 Multiple Discrimination
Type 6 Concept Learning
Type 7 Principle Learning
Type 8 Problem Solving[45]

Gagne thus conceives of problem solving as being the most complex type of learning. He also stresses that learning

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[44] Robert Gagne, The Conditions of Learning (New York: Holt, Rinehart and Winston, 1965).

[45] Ibid., pp. 33-59.

is cumulative. Thus, problem solving occurs after other necessary prerequisite capabilities have been learned. In terms of map reading skills, it is to be expected that map interpretation may most closely resemble problem solving depending, of course, on the nature of the skill being tested. Map interpretation may, therefore, be the most difficult skill for grade nine students to master.

Certain notions about learning and how to promote learning have emerged over the years. Although no specific "truths" are so established that they may not possibly be revised at some future time there are many principles of learning about which there is fairly firm agreement. Some of the more notable of these principles are stated below:

(1) Learning proceeds more effectively when the learner is motivated to learn.
(2) Children learn how to learn; therefore, how one learns in school tends to determine how one will learn in the future.
(3) Learning always takes place in relation to some goal.
(4) Learning may take place in a group, but it is always a very personal activity.
(5) Learning is not additive, it is integrative.
(6) Understanding facilitates learning. When material learned is meaningful, and when the learner is made aware of the total setting surrounding the learning being attempted, it will be remembered longer and recalled more easily.
(7) All new learning must build on previous learning.
(8) The child's self concept is a powerful determiner of his learning success.
(9) The learner learns skills in connection with activities of which they are an integral part.

(10) Active participation is more effective than passive participation in proposing, planning, executing, and evaluating the learning experiences.
(11) Material that must be retained over a long period of time must be reviewed in meaningful and varied situations.
(12) Transfer to new learning tasks will be improved if the learner sees relationships for himself, and applies the principles to a variety of situations.
(13) A learner's perception of a situation determines his conceptions and behaviour in that situation.
(14) Evaluation must be an integral part of the learning process.[46]

Different theories of learning may place different emphases on the ideas listed above and may in fact omit some ideas and include still others not listed. Learning is generally conceived of as an active and dynamic process even though different explanations may be offered for the motivation, the conditions of learning, and the behavior of the learner. There is also agreement among learning psychologists on the fundamental idea that in order to learn, the student must act, react, and organize his experiences.

The principles listed above have particular relevance for the social studies curriculum of the Province of Newfoundland. These learning principles form part of the underlying basis for the proposed revision of the social

[46]Division of Curriculum, The Master Guide for Social Studies, K-XII in Newfoundland and Labrador (St. John's, Nfld.: Department of Education, n.d.), pp. 82-83.

studies program in Newfoundland and Labrador. It is especially significant to note that evaluation is singled out as playing an "integral part" in the learning process. The evaluation of map reading skills as part of the social studies program can certainly be viewed as being in harmony with the principles of learning.

Child Development

Some of the general characteristics of learners about which agreement has been reached to a large extent are summarized in seven general principles of growth and development suggested by Olson and Hughes:

1. Children differ in rate and level of growth.
2. Growth tends to be unified.
3. Children differ in the pattern of growth.
4. Growth with time is a highly individual matter.
5. Growth has stability and continuity and makes demands for nurture.
6. Membership in a given family influences the pattern of growth.
7. Children viewed as wholes are more alike than when viewed as parts.[47]

Millard further outlines four general principles of growth and development that account for variation in developmental patterns:

1. Growth is qualitative as well as quantitative.
2. Growth is continuous in reference to beginning and end points of cycles.

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[47] W. C. Olson and B. O. Hughes, "Concepts of Growth: Their Significance for Teachers", in Educational Psychology, ed. Arthur P. Colardarci, (New York: Dryden Press, 1955), pp. 65-81.

3. Growth patterns are individual in reference to:
   (a) rate of all kinds of learning and growth
   (b) present status
   (c) variations within a pattern
   (d) maximums or ceilings
   (e) timing of sequence in a given individual's pattern
4. Growth is modifiable.[48]

If the above principles do in fact hold true, then children must be offered opportunities for participating in increasingly complex experiences while at the same time ensuring that they do not develop erroneous concepts.

It is the complete environment of the child that supplies the context within which growth occurs. Since there are differences among children of the same age group, teachers can expect different reactions to the school environment. Olson and Hughes caution, like Piaget, that the child is not a passive recipient of stimulation; he also makes demands on the environment for "nurture" according to his level of maturity.

> He reacts selectively to the surroundings that are supplied and creates his own world within them. He tends to reject the experiences for which he is not ready. Teachers may make full use of 'seeking' behavior by providing a school environment in which children find suitable experiences of a wide variety in kind and difficulty. No narrowly conceived curriculum of fixed content can attain this goal.[49]

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[48] C. V. Millard, Child Growth and Development (Boston: D. C. Heath and Company, 1958), pp. 10-17.

[49] W. C. Olson and B. O. Hughes, "Concepts of Growth: Their Significance for Teachers", in Educational Psychology, ed. Arthur P. Colardarci (New York: Dryden Press, 1955), pp. 65-81.

It may be said, then, that development is basically a product of maturation and nurture. The stimulation from the environment and the "seeking" behavior of the child must interact together. Achievement in school subjects thus results from maturation and from the available experiences. Those pedagogues who institute map reading programs must ensure that educational goals are clearly stated and that educative experiences are provided to assist the pupils to attain the goals. The degree of successful attainment of goals, is, of course, determined through systematic evaluation.

It is extremely important that persons charged with nurturing the early learning of a child should agree on the kinds of things that should be learned. Otherwise, the child may be subjected to opposing objectives and methods. Statements of general objectives pertaining to map reading skills and suggested experiences at each grade level for developing those skills is provided by a number of sources in the social studies program of the Province of Newfoundland. Classroom textbooks should be used in conjunction with other supplementary materials deemed necessary by a classroom teacher to develop appropriate skills. The general outline of skill sequence is suggested by two publications of the Newfoundland Department of Education:

(a) Map and Globe Skills: K-7[50] and (b) Design for Social Studies K-VI.[51] The degree to which individual teachers follow faithfully these sources in stating objectives and providing experiences may very well vary from teacher to teacher. The objectives do, however, provide a focus for selection and presentation of those experiences deemed to be within the comprehension of students at a particular time. The selection of objectives by this researcher to be assessed by the map reading test focuses on a number of elements or components of each skill. Based on the review of literature and research in the following chapter, it is the position of this researcher that as the child develops and grows, he will be able to deal effectively with the more complex elements of each map reading skill. By analysis of student performances on the map reading test, the growth of every child in each of the skill objectives may be ascertained. The elements of each skill area that require further nurture and development through appropriate student experiences may then be identified.

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[50]Division of Curriculum, Map and Globe Skills: K-7 (St. John's, Nfld.: Department of Education, n.d.).

[51]Division of Curriculum, Design for Social Studies K-VI in Newfoundland and Labrador (St. John's, Nfld.: Department of Education, n.d.).

Readiness

The material discussed concerning genetic epistemology, the psychology of learning, and child development raises the question of the child's readiness for specific learning experiences.

The principle of readiness is defined by Ausubel as:

> . . . the idea that attained capacity limits and influences an individual's ability to profit from current experience or practice.[52]

Thus, readiness refers to the adequacy of the existing capacity in relation to the demands placed on a child by a given learning task. Ausubel draws attention to the fact that difficulties arise when readiness is confused with the concept of maturation or a process of "internal ripening".

> It (maturation) encompases those increments in capacity that take place in the demonstrable absence of specific practice experiences--those that are attributable to genetic influences and/ or incidental experiences. Maturation, therefore, is not the same as readiness, but is merely one of the two principal factors (the other being learning) that contribute to or determine the organism's readiness to cope with new experience.[53]

Consequently, whether or not a child is ready for a new experience is not dependent solely on maturation, but

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[52]D. P. Ausubel, "Viewpoints from Related Disciplines: Human Growth and Development", Teachers College Record, 60 (December, 1959), p. 247.

[53]Ibid., p. 248.

in many cases is a result of a previous learning experience, and most often depends on varying proportions of maturation and experience. To say that readiness is a matter of simple genetic regulation would be to say that the school is powerless to influence the readiness of children for specific learning experiences. While it is important to note that the readiness of pupils at any time determines the school's current choice of instructional methods and materials, it is also important to consider that the readiness of the child is partly determined by how appropriate and efficient were the previous instructional practices to which the pupil was exposed.

Bruner referred to the spiral approach to curriculum:

> An essential point often overlooked in the planning of curricula . . . is that the basic ideas that lie at the heart of all science and mathematics and the basic themes that give form to life and literature are as simple as they are powerful.[54]

Ideally, according to Bruner, education proceeds by identifying these fundamental ideas and then elaborating and expanding on them. Thus, he states:

> A curriculum as it develops should revisit these basic ideas repeatedly, building upon them until the student has grasped the full formal apparatus that goes with them.[55]

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[54] J. S. Bruner, The Process of Education (Cambridge: Harvard University Press, 1963), pp. 12-13.

[55] Ibid., p. 13.

In applying these ideas to geography in the schools, it is important to ascertain the basic structure and concepts of the subject. Courses in geography that serve to familiarize the student with basic geographic tools such as maps, globes, diagrams, and models of various types are on the right track to presenting the basic structure of the discipline.

In terms of readiness, then, it is the task of the educator to translate the basic structural concepts of each subject into a form appropriate to the level of development of the child. The creation of appropriate teaching methods and materials to take optimum advantage of existing degrees of readiness and to increase or foster readiness wherever necessary would be desirable.

Primary significance must also be given to the fact that each student approaches each new learning task with a somewhat different set of previously learned concepts and skills. To be effective, then, a learning program for each child must take fully into account what he knows already. One must find out what prerequisite concepts and skills a child has already mastered. One approach to this task is to develop and use the required testing instruments which would provide the teacher with the necessary information. Tests that would provide relevant information about present levels of concept and skill attainment would be of value in determining which pupils were ready for specific new learning experiences and which would require additional learning experiences.

Curricular and Instructional Theory

Instructional Theory

Key elements to include in a theory of instruction have been recommended by the psychologist, Jerome Bruner.[56] First, the theory should specify experiences which most effectively foster a "favourable disposition toward learning" generally and toward the particular educational topic at hand. Secondly, it should indicate how to structure the body of knowledge so that the student can readily learn and use it. Thirdly, the instructional theory should specify optimal sequences in which to present learning experiences. The optimal sequence will provide for the required cumulative learning. Fourthly, the theory should specify the nature of rewards and punishments so as to facilitate meaningful school learning. The lure of discovery is viewed as being a highly motivating factor.[57]

The second and third components of this theory are particularly relevant to the task undertaken by this

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[56] J. S. Bruner, Towards a Theory of Instruction (Cambridge: Harvard University Press, 1966), pp. 40-41.

[57] Ibid.

researcher. An attempt has been made in the statement of objectives assessed by the map reading test to outline several of the key elements central to the mastering of each skill as a whole. Consequently, twenty-eight objectives have been identified for assessment across six skill areas. Consideration has also been given to identifying and assessing simple skill elements and the more complex skill elements that are based upon them. An examination of test performance will therefore permit a diagnosis of those areas of skill strengths and weaknesses.

In the spiral curriculum, the manner of presenting concepts depends, of course, on a pupil's level of intellectual maturation. At each age level a child has a particular way of viewing the world and the fundamental concepts must be translated into a form that corresponds with his level of development. This is by no means an easy task.

Curriculum Theory

The curriculum worker who adopts the ideas of Bruner may seek the structure of a subject, may decide to teach it as early as possible and do what he can to make the learning situation highly motivational, but he may still lack a practical system for reaching his major objectives with any precision. Hilda Taba has suggested a method of thinking about curriculum planning that supplements Bruner's views.

The essence of Taba's work is that significant curriculum development lends itself to a logical order that must be followed if confusion is to be avoided. The suggested order involves the following steps:

(1) Diagnosis of needs.
(2) Formulation of objectives.
(3) Selection of content.
(4) Organization of content.
(5) Selection of learning experiences.
(6) Organization of learning experiences.
(7) Determination of what to evaluate and of the ways and means of doing it.[58]

In light of these steps, the structure of a subject can be used as a yardstick for selecting appropriate content, particular objectives can be established, and learning experiences can be selected and organized so as to achieve the desired outcomes. The selection and organization of content and learning experiences may not be looked upon as always proceeding in the sequence outlined, as these steps often interact with one another. Evaluation, though the final step, is not meant to be purely summative, but permeates the whole process as a formative function as well. The determination of what to evaluate and of the ways and means of doing it is of central importance to the educational process.

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[58] H. Taba, Curriculum Development (New York: Harcourt, Brace and World, Inc., 1962), pp. 175-181.

Evaluation

The evaluation procedures used in the educational process serve a number of functions as suggested by Thorndike and Hagen:

(1) Motivation
(2) Diagnosis and Instruction
(3) Defining Teaching Objectives
(4) Differentiation and Certification of Pupils[59]

Based on the above listed purposes, it may be assumed that evaluation is an essential part of any curriculum. The use of tests is one manner of gathering data for evaluation. The second and third functions listed above are prime considerations in the development of the map reading test. Whether used at the beginning, during the course of, or at the end of a unit of study, the map reading test and accompanying statement of objectives are meant to identify areas of student strengths and weaknesses in specific map reading skills. Such information should prove invaluable in giving direction to teachers for providing remediation and enrichment experiences for students.

Whenever someone has a desire or a need to measure some quality possessed by a group or an individual, he is faced with the problem of choosing the best instrument for his purpose. There may be several published standardized

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[59] R. L. Thorndike and E. Hagen, Measurement and Evaluation in Psychology and Education (3rd ed., New York: John Wiley and Sons, Inc., 1969), pp. 31-33.

tests that have been developed for his purpose or he may decide to develop a test himself if an appropriate instrument cannot be found. In recognition of the need for a close relationship between stated objectives and individual test items this researcher was unable to discover a map reading test that addressed itself specifically to the objectives of textbooks used in the provincial geography programs and curriculum guides as published by the Newfoundland Department of Education. The statement of specific objectives to be assessed by the test was also a prime consideration for diagnosis of student needs based on test performance. This researcher also believed that such diagnostic information would facilitate teacher selection of activities most appropriate to the demonstrated requirements of his students by a teacher.

The purpose of this study, then was the evolution, try-out, development, and standardization of a final form of a map reading test for beginning grade nine students in the Province of Newfoundland and Labrador.

DEFINITIONS

For the purpose of this study, the following definitions will apply:

Direction--The position of an object or path of movement in relation to the cardinal and intermediate points of the compass.

Elementary grades--Encompass kindergarten to grade six inclusive.

Elevation--The vertical distance above a datum. On land maps it (the datum) is commonly mean sea level.[60]

Geography--The science of the earth and its life; especially the description of land, sea, air, and the distribution of plant and animal life, including man and his industries, with reference to the mutual relations of these diverse elements.[61]

Grid--A network of lines used for finding places on a map.[62]

Intermediate Grades--Encompass grades four, five, and six.

Junior High Grades--Encompass grades seven, eight, and nine.

Legend--An amplification or explanation of the cartographic conventions used on a map.[63]

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[60] The Royal Society, Glossary of Technical Terms in Cartography (London: The Royal Society, 1966), p. 16.

[61] D. Stamp and A. Clark, eds., A Glossary of Geographical Terms (London: Longman Group, Ltd., 1979), p. 220.

[62] Ibid.

[63] The Royal Society, op. cit., p. 24.

Location--Site or situation in relation to surroundings.

Map--A conventional representation, normally to scale and usually on a flat medium, of a selection of material or abstract features on or in relation to the surface of the earth.[64]

Map Reading--Recognition and comprehension by users of the content of a map.[65]

Primary Grades--Encompass kindergarten to grade three.

Scale--The ratio of the distances on a map to the actual distances they represent on the ground.[66]

Skill--Anything that the individual has learned to do with ease and precision: may be either physical or a mental performance.[67]

Standardized Test--A test for which content has been selected and checked empirically, for which norms have been established, for which uniform methods of administration and scoring have been developed and which may be

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[64] The Royal Society, Glossary of Technical Terms in Cartography (London: The Royal Society, 1966), p. 234.

[65] The International Cartographic Association, The Multilingual Dictionary of Technical Terms in Cartography (Wiesbaden, Germany: Franz Steiner Verlag GMBH, 1973), p. 350.

[66] The Royal Society, op. cit., p. 36.

[67] C. V. Good, ed., Dictionary of Education (New York: McGraw-Hill Book Company, 1973), p. 536.

scored with a relatively high degree of objectivity.[68]

Symbols--Conventional signs used on maps to represent specified objects; they are usually explained on the face of or below the map.[69]

SUMMARY

In summarizing the material discussed in this chapter, this researcher first made note of the central importance of map reading as an important skill in many social science disciplines, as well as in the various areas of the social studies curriculum.

The ideas of Jean Piaget and Jerome Bruner were discussed in some detail throughout this chapter. It is worthy of note that both Piaget and Bruner when discussing cognitive development have referred to a series of steps or stages. Piaget's stages of sensori-motor, preoperations, concrete operations, and formal operations correspond roughly to Bruner's enactive, iconic, and symbolic levels of thought development.

In both Piaget's and Bruner's works, the various levels of thought are not completely discrete psychological stages in the sense that they adhere to strict chronological

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[68] C. V. Good, ed., Dictionary of Education (New York: McGraw-Hill Book Company, 1973), p. 603.

[69] D. Stamp and A. Clarke, eds., A Glossary of Geographical Terms (London: Longman Group, Ltd., 1979), p. 470.

age limits. It is important that physiological and psychological stages of development be described so that teachers will be able to more accurately note the developmental characteristics of their pupils. They will thus be more effective in providing learning experiences suitable to the needs of a student at a particular level and also for providing for his needs for growth toward succeeding stages.

It should be recognized that such stages or levels are only descriptions that reflect changes that occur on a continuum of growth. While a given stage may be descriptive of the general characteristics of a group of children, not all of the individuals in the group would necessarily be at the same point on the continuum. What is of importance to the teacher in both the teaching and evaluation of children is that within reasonable age limits, children can be expected to have reached points of development where the presentation of materials and ideas in increasingly abstract contexts will be acceptable.

This chapter has presented an overview of the problem which is the focus of this thesis. A need for this undertaking has been outlined. The problem has been discussed in light of its relationship with social science disciplines, genetic epistemology, child development learning psychology, and curriculum and instruction theories. In summarizing this chapter and outlining how all of the above listed items relate to map reading skills, this researcher will comment on a most appropriate statement made by Hanna, et al.:

> The central purpose of our geographic content and skill program is the development of a system of procedures and of the basic tools which will foster a child's ability to observe, to analyze, to interpret, and to understand man's response to his physical and cultural environment. Two of the most valuable tools in the process of thinking and behaving geographically are the map and the globe.[70]

Based on the material presented in this chapter, it is this researcher's view that the growth of intellectual skills and of the abilities mentioned by Hanna is a gradual and continuous process which is fed by experience. It is assumed that even very young children can deal with concepts and skills which are within their background of experience. Recognition is also given to the difficulty of considering mental "growth" independent of learning. However, in an educational sense it means providing specific learning experiences and arranging teaching strategies which permit development of skills and concepts in keeping with the experiential background of the student.

The development of geographic concepts and map skills is a slow, sequential, and cumulative process. Teachers at

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[70] P. Hanna, R. Sabaroff, G. Davies, C. Tarrar, Geography in the Teaching of the Social Studies: Concepts and Skills (New York: Houghton Mifflin Company, 1966), p. 7.

every grade level have the responsibility of organizing learning experiences that enable the learner not only to acquire the necessary skills and understanding, but to maintain them at successively higher levels.

The major task of the school, then, is to organize or arrange experiences that match the capacities of the children. It would appear that with added maturity, children would learn specific subject matter in less time, require less practice, and be able to apply what they learn to problems more readily. It may be argued that perhaps such learning experiences should be postponed to later grades. This author believes, however, that the postponing of all geographic and map experiences to junior high grades, for example, would deprive younger pupils of the use of one of the most fundamental tools in the social studies program--the map. Therefore, the school has the responsibility of organizing appropriate readiness programs to ensure a gradual development of understandings so that children are not suddenly plunged into teaching-learning experiences in geography at a specific time in the junior high grades. Consequently, at each grade level, geographic skills and concepts should be developed to the extent that children's abilities, maturity, and previous experiences allow. Evaluation instruments are viewed by this researcher as being necessary for ascertaining current skill levels, for making relative comparisons of individuals and/or groups, and for noting student progress or lack thereof in specific skill areas. In conclusion, therefore, the purpose of this study was to design and standardize an instrument which would fulfill those criteria as they pertain to the attainment of beginning grade nine students' map reading skills in the Province of Newfoundland.

The remainder of this thesis will deal with a review of research and related literature in Chapter II, an outline of test development procedures in Chapter III, a description of research methodology in Chapter IV, conclusions and recommendations arising out of the study in Chapter V, and a summary of the thesis as a whole in Chapter VI.

CHAPTER TWO

REVIEW OF RELATED RESEARCH AND LITERATURE

Introduction

In chapter one it was stated that the purpose of this study was to develop and standardize an instrument which could be used to assess selected map reading skills of grade nine students in Newfoundland. According to the design of the social studies curriculum (particularly geography) available in Newfoundland, pupils are supposed to have already learned many basic map reading skills before reaching the junior high school grades.

This researcher has examined the field of research literature pertinent to the map skills discussed in this thesis and has selected those studies for discussion that are particularly relevant.

Many studies of the map reading abilities of children have been conducted over the last several decades. Some of these studies have focused on assessment of students' map-reading abilities; others have attempted to study the effects of instruction on the acquisition of various map reading skills; and still others have focused on the sequential development of map reading skills.

The various studies selected for this review do not all deserve the same degree of treatment. Therefore, some material will be discussed in detail because it is highly related to the present study; some material will only be briefly described because it is of less significance to this study and some studies may simply be referred to as they may be replicates of one of the other two types of material listed or they may be illustrative or supportive of a particular point being made.

In this chapter the review of literature and empirical research is divided into three major sections because of the nature of the problem. Section one will examine from an historical point of view those that have focused on assessment and instructional development of map reading skills at various age and grade levels throughout the curriculum. Section two will deal more directly with the problem addressed by this study by focusing mainly on those studies that have dealt with the development and standardization of map reading assessment instruments. It will also deal with studies of map reading skills as they pertain to Newfoundland students. The third section of the review will concern itself with supplementary research on the periphery of the problem with thoughts on the problem by eminent authorities. More specifically, it will deal mainly with literature on the sequencing of map reading skills. The final section of this chapter will consist of a summary.

MAP READING SKILLS

Historical Perspective

This section of the chapter will discuss the various selected studies that have some relevance to this study which have been conducted during the past sixty years.

In 1922 Douglas Ridgley brought attention to some examples of the false notions students have concerning directions.[71] He also noted several examples of the wrong way to teach directions to children. Ridgely contended that the correct teaching of directions in space seemed to depend on the proper use, in the early experience of pupils, of directions in space as determined by the sun, shadows, and stars rather than by teaching directions in the classroom or along a street or roadway. He emphasized the importance that pupils be taught at the very outset of map making to interpret directions on maps in terms of directions in space. This work could be begun with the construction of the first maps of the classroom, school grounds, and school locality. When wall maps or maps in the textbook are introduced, practive should be given in order to compel students to interpret map directions with respect to correct space directions.

[71] D. C. Ridgley, "The Teaching of Directions in Space and on Maps", Journal of Geography, 21 (February, 1922), pp. 66-72.

The position is taken that in early map work it is sufficient to teach pupils that the top of the map is north, the bottom south, the right-hand east, and the left-hand west. When pupils work with more advanced maps in later grades, it is necessary to teach that on all maps meridians indicate north-south directions and parallels east-west directions.

A study was carried out by Howe in 1931 in an attempt to determine elementary students' knowledge of directions in space and on a map.[72] His study involved thirteen hundred students from kindergarten to grade six in three schools. The test, which had been designed by the investigator, was administered to students individually. In general, the results of the study indicated that students' knowledge of direction in kindergarten to grade two where geography was not taught was extremely poor. In grades three to six, where geography was part of the curriculum, the students' knowledge of direction improved somewhat, but was generally very poor as well. Howe arrived at a number of conclusions: (1) children had not acquired any knowledge of directions outside of school, (2) children seemed to have learned the wrong associations in determining directions, and (3) elementary grade students had not

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[72] G. F. Howe, "A Study of Children's Knowledge of Directions", Journal of Geography, 30 (June, 1931), pp. 298-304.

been taught directions systematically, thoroughly, and accurately.[73]

Millar in 1931 reported on a study of the map reading ability of eighth grade students carried out by the Bureau of Research, New York City schools.[74] The results indicated that students were weak in determining directions on maps, using scale, and interpreting map symbols.

In 1932 Howe conducted a study that involved nine teachers and their classes representing two hundred seventy-four children in grades one, two and three.[75] They were taught directions out-of-doors by reference to the sun's rising, setting, and noon day positions, as well as by using a shadow stick. The study was conducted over ten weeks at the conclusion of which each pupil was individually tested. It was found that more than 50 percent of the first graders gave correct answers with an increase to 75 percent and 88 percent in grades two and three respectively. Based on these findings, Howe arrived at a number of conclusions: (1) children can systematically and accurately acquire a clear concept of directions in space, (2) children can and

[73] G. F. Howe, "A Study of Children's Knowledge of Directions", Journal of Geography, 30 (June, 1931), pp. 303-304.

[74] G. J. Millar, "Testing Map Reading Ability", Journal of Geography, 30 (January, 1931), pp. 38-42.

[75] G. F. Howe, "The Teaching of Directions in Space", Journal of Geography, 31 (May, 1932), pp. 207-210.

should be taught directions outside of the classroom in order to exclude the probability of association with local objects, (3) though it may be desirable to introduce instruction earlier, evidence points to the third grade level as the most favorable for comprehension.[76]

Howe in 1933 conducted a study to discover whether elementary school children were developing the necessary skills for the understanding of maps.[77] More specifically, the study had two purposes: firstly, to measure the ability of children to use map symbols in the fourth, fifth, and sixth grades, and, secondly, to determine if a remedial program could overcome defects by adequate teaching along specific lines. At first, the experimenter found a very low percentage of correct answers in a major portion of a pre-test. The remedial work carried on with the fifth and sixth grade levels resulted in significant gains in practically every question. Howe then made a number of recommendations: (1) courses of study should provide for systematic development of map reading techniques, (2) better

[76] G. F. Howe, "The Teaching of Directions in Space", Journal of Geography, 31 (May, 1932), p. 210.

[77] G. F. Howe, "A Study of the Ability of Elementary School Pupils to Read Maps", in The Teaching of Geography, ed. G. M. Whipple, Thirty-Second Yearbook of the National Society for the Study of Education (Bloomington, Illinois: Public School Publishing Co., 1933), pp. 486-492.

teaching techniques were needed, (3) an awareness of the significance of correct map usage in the child and teacher was needed.[78]

The purpose of the study conducted by Thorp in 1933 was to determine how well children were learning to use those tools necessary for effective geography study.[79] The test focused on the following: (1) globe study, (2) map-reading, (3) climatic elements, (4) index and appendix, (5) graph reading.

Tests composed of a series of graded exercises were prepared. These were given without preliminary drills or suggestive help to children in four types of schools--rural consolidated, village, small city, and large city. Five hundred fifty-six pupils were tested ranging in age from nine to fourteen years. These students were in grades four to eight inclusive and worked under varying conditions of curriculum assignment, time allotments, and materials.

One sixth-grade class was used as an experimental group in which, over a six week period prior to the taking of

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[78] G. F. Howe, "A Study of the Ability of Elementary School Pupils to Read Maps", in The Teaching of Geography, ed. G. M. Whipple, Thirty-Second Yearbook of the National Society for the Study of Education (Bloomington, Illinois: Public School Publishing Co., 1933). pp. 491-492.

[79] M. T. Thorp, "Studies of the Abilities of Pupils in Grade Four to Eight to Use Geographic Tools", in The Teaching of Geography, ed. G. M. Whipple, Thirty-Second Yearbook of the National Society for the Study of Education, (Bloomington, Illinios: Public School Publising Co., 1933). pp. 494-506.

the tests, the students received intensive drill in the use of the tests.

On the basis of the findings, Thorp arrived at these conclusions in light of the relatively poor responses on some of the tests:

> (1) Incidental teaching of the correct usage of geography tools failed.
> (2) The work was easily within the comprehension of the average sixth grader as evidenced by the number of correct responses given by the experimental group.[80]

A study was conducted by Lord in 1941 to determine the spatial orientation of students.[81] A series of four different tests was administered to children in grades five to eight in Ann Arbor, Michigan. On the basis of his findings, he concluded that the students' understanding of cardinal and intermediate directions was poor. Although this geographic skill was included in the elementary social studies curriculum, the investigator felt that there was little evidence that the students had been exposed to the necessary experiences to help them in learning directions. Lord, in conclusion, listed several recommendations based on his

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[80] M. T. Torp, "Studies of the Abilities of Pupils in Grade Four to Eight to Use Geographic Tools", in The Teaching of Geography, ed. G. M. Whipple, Thirty-Second Yearbook of the National Society for the Study of Education (Bloomington, Illinois: Public School Publishing Company, 1933), p. 505.

[81] F. E. Lord, "A Study of Spatial Orientation of Children", Journal of Educational Research, 34 (March, 1941), pp. 481-505.

study: (1) there is a need for out-of-door exercises, observations, and drills with regard to directions, (2) the teachers must assume a great share of the responsibility for the proper orientation of children under their instruction.[82]

A list of map reading skills was compiled by Wagner in 1953 which she felt were appropriate for sixth graders.[83] She tested: (1) their ability to use a key or legend to find various features on the map, (2) their ability to use knowledge of the globe in recognizing distortions of area and shape on the map, and (3) general skills such as using latitude and longitude, and information about rivers, coastlines, and directions. She concluded that the students did not have the specific skills and knowledge needed to interpret maps. Poor performance was due, she felt, to a lack of reinforcement rather than to a lack of initial instruction.

Preston in 1956 attempted to obtain information concerning children's knowledge of directions so as to compare the performance of American and German children.[84]

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[82] F. E. Lord, "A Study of Spatial Orientation of Children", Journal of Educational Research, 34 (March, 1941), pp. 481-505.

[83] L. Wagner, "Measuring the Map Reading Ability of Sixth Grade Children", Elementary School Journal, 53 (February, 1953), pp. 338-344.

[84] R. C. Preston, "A Comparison of Knowledge of Directions in German and American Children", Elementary School Journal, 57 (December, 1956), pp. 158-160.

The test questions dealt with the interrelations between bodily position (right and left), the four cardinal directions, and the position of the rising and setting sun.

The study involved administration of the test to four hundred sixth grade Hamburg children who represented a random sample of two hundred from the upper 27 percent in intelligence (based on total score) and of two hundred from the lowest 25 percent in intelligence. The test was also administered to over six hundred sixth grade pupils in American public schools chosen by a sampling procedure similar to that employed in Hamburg.

The study found that as far as knowledge of the relation between bodily position, the cardinal directions, and the sun is concerned, the American children consistently exceeded the German children. Despite this, the absolute knowledge of the American children in relation to direction was limited. The scores of the brighter group of American children ranged from as low as 38 percent to only 78 percent; and the scores of the duller group ranged from 25 percent to 42 percent. Thus, the findings suggest that many 'bright' American children in grade six do not have a very good grasp of direction.

In the year 1962 Weinswig evaluated a series of lessons designed to teach introductory map skills in grade four.[85]

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[85] S. E. Weinswig, "Evaluation of Lessons to Teach Introductory Map Skills in Grade Four," (Doctoral dissertation, Boston University, 1962).

His experiment, carried out over a five and one-half week period, involved twenty-five classes in grade four. His purpose was to evaluate a planned program with students working alone, in pairs, and in groups of three. The control group, made up of seven classes, followed the prescribed social studies program. The remaining eighteen classes were divided into three experimental groups of six classes each and were all given the same self-directed map skills lessons without teacher aid. In experimental group I, each student worked on the lessons entirely on his own; in experimental group II, students worked in pairs, and in experimental group III, the students worked in groups of three.

Prior to the experiment, the Kuhlmann-Anderson Intelligence Test, the map reading section of the Iowa Tests of Basic Skills, and the investigator's map skills test were administered in order to equate the groups. The map tests were readministered at the end of the experiment and again at two later dates. The results showed that the lessons used in the intensive teaching program were effective in teaching map skills. Each experimental group showed highly significant gains between the initial mean scores and mean scores at the end of the experimental teaching period and the delayed testing periods. Also, the experimental groups produced statistically significant differences (.01 level of significance) when compared with the control group. With regard to the team learning techniques, it was found that the greatest gains were made by students working in teams of three, followed by children working in pairs and those working alone, respectively.

The purpose of Sorohan's study conducted in 1962 was to determine the most effective grade placement of a selection of map reading skills.[86] A total of four hundred ninety-eight students in grades four, five, and six were the subjects. From six schools in a county in southeastern Ohio, twenty classes were chosen. Eleven skills were chosen and were organized into a unit plan for teaching over a four week period on a daily basis.

The mental ages of the students were obtained using the California Test of Mental Maturity-Short Form. Pre-tests, post-tests, and a retention test, four weeks after the completion of the unit, were administered. Based on this inquiry Sorohan assigned mental ages in months to be the specific requirement for mastery of each of the selected skills tested.

A study was carried out by Rushdoony in 1963 to ascertain which map reading skills recommended for children in fourth and fifth grades could be learned by children in the

[86] L. J. Sorohan, "The Grade Placement of Map Skills According to the Mental Ages of Elementary School Children," (Doctoral dissertation, Ohio State University, 1962).

third grade when advanced instruction was provided.[87] A representative sample of one hundred twenty-nine third graders from a west coast city was assigned randomly to two groups. The experimental group received advanced instruction in fourth and fifth grade reading skills for fifteen weeks, while the control group received instruction as outlined in the social studies teaching guide for grade three of the school system. The Iowa Test of Basic Skills (Work Study Skills: Map Reading) was administered before and after the training period. Following the fifteen week instructional period, the experimental group made greater gains on nearly all items than did the control group.

Rushdoony concluded that children in the third grade can benefit from an instructional program that emphasizes the introduction and development of map reading skills from the primary level to a recommended fifth grade level. Rushdoony suggested that objectives related to map skills should be placed in grades one and two as well as grade three and that this would necessitate the downward placement of several of the map skills throughout the curriculum and possibly revision of the social studies organization

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[87]H. A. Rushdoony, "Achievement in Map Reading: An Experimental Study", <u>Elementary School Journal</u>, 64 (October, 1963), pp. 70-75.

at some points in light of his study.[88] It should be noted, however, that in drawing his conclusions, Rushdoony acknowledged the limits of his study in terms of the size and makeup of his sample, as well as in the teaching methods used and the teachers involved.

The major purpose of Schiller's study in 1963 was to determine the effects of systematic and functional use of work study skills on mastery of those skills and on achievement in the social studies.[89] Two hundred ninety-six seventh grade pupils attending ten parochial schools in St. Louis, Missouri, were divided into experimental and control groups. A pre-test and post-test of work study skills including map reading were administered. Instruction in work study skills was carried out systemically in the experimental group over a period of fourteen weeks. The control group received no instruction in the use of these skills. The final test scores after the experiment showed that pupils of the experimental group achieved significantly greater mastery of each of the skills than did the pupils of the control group.

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[88] H. A. Rushdoony, "Achievement in Map Reading: An Experimental Study", Elementary School Journal, 64 (October, 1963), p. 75.

[89] M. P. Schiller, "The Effects of the Functional Use of Certain Skills in Seventh Grade Social Studies", Journal of Educational Research, 57 (December, 1963), pp. 201-203.

McAulay in 1964 carried out a study which assessed the abilities of fourth grade students to learn map reading skills.[90] Also, he attempted to assess the students' understanding of social studies content through the use of maps as opposed to reading materials. The study was carried out over a three-month period and involved seventy-four students in two classrooms from the rural areas of central Pennsylvania. Both classes studied the same unit on Pennsylvania in this investigation. In classroom A there was an abundance of teaching aids (mainly print materials and posters), but only occasional reference was made to maps whereas in classroom B there was a much lesser variety of teaching aids except that commercial maps were used extensively. At the end of the three month period, tests given to both classes indicated that students in classroom B, which had used maps extensively, achieved scores significantly higher than the students in classroom A. McAulay concluded that the children in grade four seemed to be sufficiently mature and capable of learning and using map skills early in grade four. Also, he was of the opinion that maps helped students understand social studies content more efficiently and effectively.

Arnsdorf studied a series of learning experiences which used a discovery approach with map overlays as an

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[90] J. D. McAuley, "Map Learnings in the Fourth Grade", Journal of Geography, 63 (March, 1964), pp. 123-127.

aid in building geographic understanding and map reading skills.[91] In 1964, two hundred thirty-four grade five students from ten classrooms in four different schools located in an urban community participated in the study. The experiment was conducted over a six week period. Initial measures of work study skills and reading and intelligence tests showed that the group was average or above average when compared with national norms. The students were involved in twelve lessons which used a set of map projectuals of the United States designed to help them develop an understanding of the distribution and interrelationship of physical, biotic, and cultural features.

The students scored significantly higher on post-test measures of map reading, reading graphs and tables, and knowledge and use of reference materials on the Iowa Tests of Basic Skills. The grade equivalent differences between initial and final mean scores were 1.9 years in map reading and six months for the remaining two tests. The investigator concluded that a program of instruction in social studies that emphasized the use of map overlays accelerated pupil growth in map skills and geographic understanding.

[91] V. E. Arnsdorf, "Teaching Map Reading and Geographic Understandings with Projectuals", Journal of Geography, 63 (February, 1964), pp. 75-81.

The purpose of the study conducted by Joyce in 1964 was to develop and validate statements of skills that would serve as basic guidelines for teaching children to read and interpret maps and globes.[92] Statements of ninety-one map reading skills were formulated by Joyce. The statements of skills were then submitted to a panel of three hundred fifty-one jurors who were actively engaged in teaching the social studies in grades one through six in six elected elementary school districts in the Chicago surburban area. The jurors were charged with appraising each statement to determine the grade level where each skill should be given systematic instruction. On the basis of the obtained data each skill was assigned to a grade or grades at which the jurors agreed it would be suitable for systematic instruction. It was also found that the skills, as appraised by the jurors, appeared to fall into a grade-by-grade sequential pattern for grades one through six, with various skills tending to cluster at each of the six grade levels.

Some of the more significant findings are discussed below. First, the majority of the skills comprising the ability to orient the map and note directions and to locate places on maps and globes were designated for initial

[92] W. W. Joyce, "The Development and Grade Placement of Map and Globe Skills in the Elementary Social Studies Program," (Doctoral dissertation, Northwestern University, 1964).

instruction in grade three. Second, most of the skills requiring the ability to express relative location and to read map symbols were assigned for preliminary instruction prior to and during the fourth grade. Third, a significant number of the skills involving the ability to read the scale of a map and compute distances were identified as requiring instruction in grade five and the years previous to it.

Joyce felt that the results showed that many of the juror's appraisals of the skills tended to be conservative when compared with the results of studies dealing with instruction in map and globe skills. Studies cited in research reviewed by Joyce indicated that nearly one-third of the skills listed had been taught successfully to pupils in lower grades than were indicated by the jurors. It appeared that the jurors may have underestimated the capacity of their pupils to master many of the skills which underlie the ability to read and interpret maps and globes since over three-fourths of the jurors who reported that certain skills did not merit systematic instruction on their grade level indicated that the skills were too difficult for their pupils.

An interesting follow-up to Joyce's was conducted by Stampfer in 1966.[93] Stampfer chose a selection of the

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[93]N. Stampfer, "A Study of Map Skills Attainment in Selected Middle Grades," (Doctoral dissertation, Northwestern University, 1966).

skills identified by Joyce in his study and then developed an instrument to test these selected skills. He administered the test to six hundred thirty-four students in grades four, five, and six comprising twenty-seven classes. This study involved the measurement of skills and understanding actually attained by the pupils in the classes of the teachers who acted as jurors for Joyce's study. It was therefore possible to compare teacher reports and expectations with a measure of actual attainment by the students of those teachers.

Among the more surprising findings was the fact that only 60 percent of the pupils in the fourth grade classes could ascertain cardinal directions by using body position when one direction was given. Fifth and sixth grade pupils performed only slightly better--67 percent and 68 percent respectively, despite the fact that the primary grade teachers had reported teaching this knowledge.

In the discussion of his findings, Stampfer noted that the results of the inquiry did not reveal for all items a regular pattern of development from grade to grade.[94] For instance, the skills taught systematically to students in grades one, two, and three, according to Joyce's study, were not invariably known by all or even 80 percent of the students in grades four, five, and six. The tests of significance

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[94] N. Stampfer, "A Study of Map Skills Attainment in Selected Middle Grades," (Doctoral dissertation, Northwestern University, 1966).

for score differences between grades revealed that significant differences were obtained on only about half of the items. Among the possible causes for these results which were suggested by Stampfer were the lack of opportunity for application and practice, and lack of continuity in skill development from grade to grade.

Douglass in 1965 carried out a study of which the purpose was to provide information on how well and in what manner children acquire their knowledge of directions.[95] The sample for his study involved two hundred thirty-six elementary school children in grades one to six from nine schools in southern California. The test instrument consisting of fourteen items relating to knowledge of directions and the ability to orient oneself in space was administered to the students individually out-of-doors. The results indicated that there was no apparent trend towards greater proficiency in responding to the test items from the earliest grades through to the later grades. That is, students in the first and second grades scored as well on this test as did their older counterparts in the elementary grades. It was noted, too, that the boys scored consistently higher than the girls. The difference in means was significant at the .01 level of confidence.

[95] M. P. Douglass, "Laterality and Knowledge of Directions", Elementary School Journal, 66 (November, 1965), pp. 69-74.

In 1965 Bartz completed a major study of map design and children's map reading abilities.[96] She tested two hundred thirty-three children in grades four through nine at four different locations: Albuquerque, New Mexico; Oak Park, Illinois; Suring, Wisconsin; and Union, New Jersey. The children were interviewed individually for about fifteen to thirty minutes each. Test questions were based on eleven maps from the 1964 World Book Atlas ranging in scale from 1:1,000,000 to 1:42,000,000. The questions covered eleven different types of map reading skills: (1) general, (2) latitude and longitude, (3) direction, (4) scale, (5) symbol comprehension, (6) comprehension of layer tints, (7) political areas, (8) names and lettering, (9) insets, (10) generalization, (11) miscellaneous. The purpose of the test was first to determine what the children understood of symbolization in general, as well as what they knew of specific symbols; and second, to gain some insight into the general problem of how children read maps.

The results of the test showed that children were familiar with latitude and longitude, but they were unable to apply the concepts to problems of locations. They also understood cardinal directions, but had difficulty with map orientations other than that of "north at the top".

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[96] B. Bartz, Map Design for Children (Chicago: Field Enterprises Educational Corporation, 1965).

Generally, the directions east and west were more difficult to work with than were north and south. Directions such as northwest were difficult to work with; the children preferred to say "north and west".

Linear scale was poorly understood until about the seventh grade. But it was applied with difficulty even after that age. Until the seventh grade, most children did not even use the bar scale! They were also unable to work successfully with area scales.

Arbitrary symbols had to be clearly represented in the legend for them to be understood. Even then, many children failed to refer to the legend. The children showed nearly 100 percent comprehension on only four conventional symbols:

(1) black dot for city or town

(2) star for capital

(3) curved blue line for river

(4) blue area for lake or ocean

According to Carmichael, in 1965 students acquired map reading skills and developed better geographic understandings when taught by a conceptual method rather than by an expository method.[97]

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[97] D. R. Carmichael, "Developing Map Reading Skills and Geographic Understandings By Means of Conceptual Teaching Methods," (Doctoral dissertation, University of California, 1965).

His investigation involved three hundred fifty-two students randomly assigned to two treatment groups. The experimental group was involved in a unit of study which concentrated on the learning of geographic concepts, relationships, and generalizations, and stressed thinking strategies rather than factual knowledge. The control group used an expository textbook-centered approach, with the concepts and generalizations being related by the teacher or in the textbook. Prior to the experiment, students were given standardized tests of intelligence to determine I.Q., mathematics, and reading achievement levels. At the end of the instructional period, a standardized map reading test and an unpublished test of geographic understandings were administered to the groups. The results indicated that students in the experimental groups showed greater improvement in both map-reading skills and geographic understandings.

In 1966 McAulay conducted a study of second grade children to determine their growth in comprehension of geographic understandings.[98] Three specific aspects of geographic understandings were assessed. These were environment, map and globe use, and geographic drawings. The study involved thirty-four children from families in

[98] J. D. McAulay, "Second Grade Children's Growth in Comprehension of Geographic Understandings", Journal of Geography, 65 (January, 1966), pp. 33-37.

the upper socio-economic group from a community south of Pittsburgh, Pennsylvania. Tests on each aspect of geographic understandings were administered to the students individually in September and again in May. The results indicated that these second grade students had developed sufficiently in geographic understanding to transfer the immediate, observed environment to an illustrated map representation and to use a globe to solve particular problems. In the September pre-test only nine students out of the thirty-four could read and interpret the map and the globe in a general way. In May this number had increased to thirty. Although the students in this study displayed excellent progress over the nine month period, the investigator cautioned that some of their geographic maturity may have been attributed to the fact that they were from families with high socio-economic status.

According to Towler and Nelson in 1968 there was widespread disagreement among educators as to what geographic skills should be introduced in elementary grades. In their study with respect to the abilities of elementary school children in the use of scale, they concluded that most children do not develop a concept of scale before the ages of ten or eleven.[99]

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[99] J. O. Towler and L. D. Nelson, "The Elementary Child's Concept of Scale", Journal of Geography, 67 (January, 1968), pp. 24-28.

For their study, Towler and Nelson selected sixty boys and sixty girls in grades one to six from three elementary schools, Edmonton, Alberta. Each student was involved in two testing situations--an intelligence test and an individual battery of subtests designed by the investigators. Their findings indicated that the growth of the concept of scale showed no significant correlations with factors of sex or socio-economic status. However, there was a significant correlation with chronological age, intelligence and grade level. The experimenters concluded that, with the existing methods of instruction, children did not fully understand the concept of scale until they had reached grades five or six. However, Towler and Nelson stated that their findings:

> . . . do not preclude the development of techniques which might develop the child's understanding of scale at a much earlier age than is now the case.[100]

Rushdoony in 1968 published a review of research conducted during the previous two decades.[101] He listed six categories representative of the skills that had been tested:

(a) size and shape

(b) orientation and direction

(c) location

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[100] J. O. Towler and L. D. Nelson "The Elementary Child's Concept of Scale", Journal of Geography, 67 (January, 1968), p. 28.

[101] H. A. Rushdoony, "A Child's Ability to Read Maps: Summary of the Research", Journal of Geography, 67 (April, 1968), pp. 213-222.

(d) distance

(e) symbols

(f) map inference

He summarized the results of this research by drawing these three general conclusions:

> (1) There tends to be a grade-to-grade progression in children's ability to read maps.
> (2) Children's errors and misconceptions tend to be at least in part related to the lack of any extensive systematic teaching of map-reading.
> (3) There tends to be a stress on what children know or do not know, rather than on what they can learn from systematic instruction.[102]

Carswell investigated the topographic map reading and interpretation abilities of students in grades four, five, and six in 1968.[103] Particular skills assessed were the ability to read symbols, direction, scale, elevation, and grid systems as well as the ability to interpret information from the map. For the study, fifteen classes were selected in consultation with the Calgary Separate School Board in Alberta. At each grade level, four classes were arbitrarily assigned to the experimental group and one to the comparison group. Before instruction, a comparison of

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[102] H. A. Rushdoony, "A Child's Ability to Read Maps: Summary of the Research", Journal of Geography, 67 (April, 1968), pp. 213-222.

[103] R. J. B. Carswell, "Topographic Map Reading Abilities of Learners in Grades Four, Five, and Six," (Doctoral dissertation, University of Florida, 1968).

the two groups indicated that there were no significant differences on Carswell's constructed Test of Topographic Map Skills, the Iowa Tests of Basic Skills-Mapreading Subtest, and mental age. At the end of the instruction period a post-test was administered and results showed that in each grade there was a significant gain in ability of students in the trial group while the comparison groups did not make any improvement that was statistically significant. Specific findings were as follows:

> (1) Symbols and directions are the least difficult skills and may be mastered in the intermediate grades.
> (2) Scale, grid system, and elevation seem to be of equal difficulty and may be learned and used in the intermediate grades.
> (3) Interpretation appears to be a complex skill that requires further research before conclusive statements are made.[104]

Carswell went on to point out that map skills were a part of the social studies curriculum, yet students' abilities in these skills were very poor. He felt that teachers over-estimated their success in teaching map reading skills. He cited four reasons why teachers were not adequately teaching map skills:

> (1) There is a gross oversimplification in the minds of teachers of just what is involved in the reading of a map.

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[104] R. J. B. Carswell, "Topographic Map Reading Abilities of Learners in Grades Four, Five, and Six," (Doctoral dissertation, University of Florida, 1968).

(2) The wrong things are being taught about maps. That is, teachers are probably teaching about maps rather than with maps.
(3) There is something lacking in the sequencing of map skills.
(4) The techniques which are used to teach mapping skills seem to be ineffectual if they exist at all. In many cases the teachers seem to assume that children can read a map.[105]

In 1969, Savage and Bacon investigated two methods of teaching the skill of recognizing map symbols.[106] The traditional approach of beginning with the manipulation of concrete objects was compared to a method which begins on a more abstract level. Forty first-grade pupils (twenty boys and twenty girls) randomly selected from the population of first graders in a Seattle elementary school made up the samples for the study. They were randomly asigned to the two groups of twenty each. A criterion test based on the objectives of the unit was developed by the experimenters and administered to both groups after the period of instruction. The findings supported the hypothesis that there was no significant difference in the two groups with respect to

[105] R. J. B. Carswell, "Topographic Map Reading Abilities of Learners in Grades Four, Five, and Six," (Doctoral dissertation, University of Florida, 1968).

[106] T. V. Savage and P. Bacon, "Teaching Symbolic Map Skills with Primary Grade Children", Journal of Geography, 68 (November, 1969), pp. 491-497.

recognizing map symbols. The experimenters concluded that there appeared to have been too much emphasis placed on the need for manipulation of concrete objects in the primary grades. It seems that first grade children could learn on a more abstract level than had been assumed possible.

Lanegran, Snowfield, and Laurent conducted a study in 1970 in St. Paul, Minnesota, with twenty educable mentally retarded boys and twenty trainable mentally retarded boys.[107] The purpose of the study was to measure the performance of educable and trainable mentally retarded children on tasks involving geographical direction. The study found that none of the boys was able to orient himself according to the conventional directions of north, south, east, and west. All of the boys, except the young trainable mentally retarded, were able to verbalize and demonstrate the concepts of relative direction and distance from self. No instruction occurred prior to testing so the study made no conclusions about possible improvement if instruction were carried out.

The purpose of Gildea's study carried out in 1971 was to determine whether or not there was a significant difference in the achievement of map skills between students at

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[107] D. A. Lanegran, J. G. Snowfield, and A. Laurent, "Retarded Children and the Concepts of Distance and Direction", Journal of Geography, 69 (March, 1970), pp. 157-160.

grades seven and nine when taught by the methods of programmed instruction as compared to students taught by the traditional lecture method.[108] While I.Q. was found to significantly affect achievement gains, teaching methods did not. In comparison with the lecture method of instruction, no substantial benefits of programmed learning with regard to the teaching of map skills were revealed at the grades seven and nine levels.

A study was carried out by Murdock in 1972 to ascertain the degree of relationship which existed between the ability to make inferences from maps and (a) selected intellectual abilities, (b) general intelligence, (c) combinations of intellectual abilities which best predicted the ability to make inferences from maps.[109]

Ten seventh grade classes in an intermediate school in southeast Los Angeles County comprised the sample of the study. The two hundred seventy-two subjects consisted of one hundred forty-nine boys and one hundred seventy-three girls. Students were given a pre-test which was followed

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[108] R. Y. Gildea, "The Effects of the Use of Self-Instructional Materials on the Learning of Map Reading Skills in Grades Seven and Nine," (Doctoral dissertation, University of Virginia, 1970).

[109] J. W. Murdock, "A Study of the Relationship Between Factors of Intelligence and Map Inferring Ability in Seventh Grade Pupils," (Doctoral dissertation, University of Southern California, 1972).

by an eleven week period of instruction in map reading utilizing two map inferring programs. Following the period of instruction a post-test of high level map skills was administered. Here are the findings of the study:

(1) The relationship between general intelligence and map inferring ability was significant for both boys and girls.

(2) The relationship between scores on the necessary Arithmetic Operations Test and the criterion variable was significant for both boys and girls.

(3) The relationship between the scores on eight of the eleven tests of specific intellectual factors and the criterion variable was significant for boys and girls.

A study was conducted by Frye in 1972 to examine the development of map reading ability in nine to fourteen year old children.[110] A stratified random sample of thirty males and thirty females in grades three to eight was selected from the Lyme Elementary School in Lyme, New Hampshire. Sex, age, class in school, and I.Q. were considered as independent variables. Six component measures of mapping ability were selected by the author. The most significant finds

[110] M. Frye, "The Development of Map Reading Abilities in Nine to Fourteen Year Old Children," (Doctoral dissertation, Claremont Graduate School, 1972).

were that: (a) there was no significant difference in the map reading abilities of males and females, (b) older children performed significantly better than younger children, (c) I.Q. was found to correlate significantly with map reading ability, (d) the students' class in school correlated significantly with map reading ability.

Chicago, Illinois, was the site of a study carried out in 1974 by Printzing.[111] Seventy-six fourth grade and seventy-six eighth grade students at four public and four parochial elementary schools in ethnically different neighborhoods of Chicago participated in the study. The students were asked to demonstrate the ability to use direction, scale, and concepts of land use on photographs, and between aerial photographs, scale 1":400', and topographic maps, 1:24,000.

Results indicated that students did much better when shown isolated items as compared to when they viewed the whole photograph. The five most identified items and the five least identified items were the same at the fourth and eighth grade levels. Students were able to match patterns of aerial photographs and topographic maps quite well, but had difficulty locating isolated items on a topographic map

[111] V. E. Printzing, "Aerial Photographs and Topographical Map Comprehension by Chicago Students of Eight Parochial Schools - Grades Four and Eight," (Doctoral dissertation, University of Northern Colorado, 1974).

when shown the items on an aerial photograph. Few had the ability to use scale in a number of situations.

A study was conducted by Schneider in 1976 to ascertain the performance level of elementary teachers and students on a test of map and globe skills.[112] In the spring of 1974 a four foil, sixty-nine item multiple choice test was administered to thirty-two college seniors enrolled in an elementary teacher education program at the University of Georgia. In June, 1974, the test was administered to sixty elementary school teachers enrolled in an M. Ed. program. Their teaching experiences ranged from one to twenty-four years. In October, 1974, the test was given to three hundred seventy-one sixth grade students enrolled in three middle schools in a major southeastern city. Finally in January, 1975, the test was given to one hundred eight sixth grade students enrolled in a middle school in a consolidated city-county system of ninety-six hundred students.

Overall, the sixth grade students scored considerably lower on the test than did the teachers. Seventy percent of the sixth graders had difficulty answering questions in eleven major categories of map and globe related skills. One item out of four on which 90 percent or more of the

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[112]D. O. Schneider, "The Performance of Elementary Teachers and Students on a Test of Map and Globe Skills", Journal of Geography, 75 (September, 1976), pp. 326–332.

sixth graders were able to respond correctly was that of naming and orienting the cardinal directions north and south. The students did experience more difficulty with east and west.

In comparison to the sixth graders, the teachers had substantially less difficulty. They did, however, exhibit many of the same weaknesses in their responses to test items. Their greatest difficulties were on items related to six of the eleven categories on which students had scored worse.

Giannangelo and Frazee conducted a study in 1977 to determine the map reading proficiency of elementary educators.[113] The map skills section of the Iowa Test of Basic Skills was administered to three hundred ninety elementary educators from the mid-south area of the United States. The participants included persons from various occupations in the field of elementary education--teachers, supervisors, and administrators.

The group responses among items testing the same skill were frequently inconsistent. This repeated inability to consistently respond correctly or incorrectly to items evaluating the same skill is a strong indication that the participants lacked a complete understanding of the map

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[113] D. M. Giannangelo and B. M. Frazee, "Map Reading Proficiency of Elementary Educators", Journal of Geography, 76 (February, 1977), pp. 63-65.

skills tested. The sixth grade conversation chart was used to compute grade equivalency scores for the group. It is interesting to note that 34.4 percent of the teachers had grade equivalency scores below the sixth grade level. None of the three hundred persons tested had a perfect score.

A study was completed by Cox in 1978 to examine the ability of elementary school children to perform map reading skills on large scale maps.[114] A test was administered to three hundred forty-nine central Illinois students in grades two, four, and six. Two different perspectives were used in the design of the test maps: a planimetric and a plan oblique perspective. Test questions were grouped as being either perceptual skills or legend skills.

The results of the study showed that students at all three grade levels performed well on perceptual skills. Students in grades four and six performed significantly better than second grade students on skills which relied on legend information. There was no significant difference between test maps, between sexes, between rural and urban schools, or between students who had or had not travelled to the area shown on the maps.

[114] C. W. Cox, "Children's Maps Reading Abilities with Large Scale Urban Maps," (Doctoral dissertation, University of Wisconsin-Madison, 1977).

In attempting to relate his findings to Piaget's theory concerning perspective, Cox notes that second graders generally did not do as well as fourth and sixth graders, but they did much better with compass directions than expected.[115] It was felt by the experimenter that second graders would respond positively to instruction in this skill because the perceptual and cognitive development of children in the concrete operational period should be sufficient to perform the skill. Cox concludes that in future research it would be most beneficial to study the effects of instruction on children's performance in map reading.

Greenham conducted a study survey in 1980 that used a sample of Newfoundland students.[116] The purpose of the study was to develop and test an instructional unit on latitude and longitude and to determine if such a unit would be useful for use with slow learning students at the junior high school level. The appropriate instructional unit was developed. It was then compared in an experimental situation to a textbook lecture method of instruction. Greenham's unit consisted basically of a slide-tape program. The two

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[115] C. W. Cox, "Children's Map Reading Abilities with Large Scale Urban Maps," (Doctoral dissertation, University of Wisconsin-Madison, 1977).

[116] L. G. Greenham, "The Development and Testing of an Instructional Package to Teach the Basic Map Reading Skills of Latitude and Longitude to Low-Achieving Junior High School Students," (Master's thesis, Memorial University of Newfoundland, 1980).

methods were compared by selecting a group of seventh grade slow learning students at Beothuk Collegiate in Baie Verte, Newfoundland, and assigning randomly the students to one of two treatment groups. The students were administered pre-tests and post-tests. A t-test showed significant score differences in favor of those students who had been taught using Greenham's instructional package.

Assessment Instruments

Included in this section of the chapter are three studies that have particular relevance to the problem addressed in this study. Two of the studies are concerned with the development and standardization of testing instruments used to assess map reading skills and the third study focuses on an assessment of map reading skills conducted by a researcher in 1978 in studying fifth grade Newfoundland students.

A study was initiated by Robertson in Quebec in 1968.[117] This investigation was concerned with the development of an instrument to be used in measuring elementary school geography attainment in grades five, six, and seven. The textbooks in use in Quebec schools served as a source of content for the development of test items. Pre-tests

[117] D. J. Robertson, "The Development and Standardization of an Objective Test of Elementary School Geography," (Master's thesis, McGill University, 1968).

were created and were administered to two hundred seventy-one students in grades five through seven in the Montreal area. When data were obtained from the separate grade pre-tests and an item analysis completed the three tests were combined to form one comprehensive test of geography achievement to cover the content of the three grades. All test items were of the multiple choice type.

This second form of the test was comprised of ninety-two items and was administered to five hundred fifty-four grade five, six, and seven students in March of 1967. Test scores were obtained for each grade and further item analysis was carried out for each item at each grade level. From the results of the second administration norms for each of the three grade levels were established. Z scores and percentile scores were developed to correspond to specific raw scores.

Robertson found the instrument to be effective in measuring the growth of geographic learnings as evidenced by significant differences in the mean scores on the test between the various grade levels. Differences were significant at the .001 level. He also found that there was a significant positive correlation between I.Q. and attainment as measured by his test, as well as between scores on the geography test and other measures of school attainment. Finally, Robertson found that boys scored significantly higher on the test than did girls. He was unable, however, to explain this difference.

The development of a standardized achievement test suitable for assessing the geographic knowledge and skills of fifth grade students in Michigan was undertaken in 1972 by the Michigan Council for Geographic Education. The Michigan Elementary Geography Test was completed in 1973 and contained twelve figures and fifty questions. In 1975 Bettis and Manson administered this test to one thousand six hundred eighty-nine fifth grade students in sixty-four classrooms from twenty school districts in Michigan.[118] Results of the test showed that over 50 percent of the students demonstrated some proficiency in the area of geographic skills, especially with respect to questions concerning map symbols and reading of graphs. However, it was found that Michigan students were not proficient at calculating distance, determining direction, or interpreting graphs because less than 50 percent of the students correctly answered questions concerning these skills.

It should also be noted that the objectives assessed by the Michigan Elementary Geography Test were not derived from the curricula and textbooks found in Michigan's fifth grade classrooms and did not, therefore, necessarily

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[118] N. C. Bettis and G. A. Manson, "An Assessment of the Geographic Learning of Fifth Grade Students in Michigan", Journal of Geography, 74 (January, 1975), pp. 16-24.

correspond to ongoing programs and practices. The findings of Bettis and Manson attest to the need for an assessment of the teaching and learning of geography in the elementary schools.

One study that has particular relevance for the map reading skills of Newfoundland students was carried out in 1979 by Russell Pack.[119] The purpose of Pack's study was to assess the attainment of grade five students in eight selected geographic skills. The forty multiple choice item test attempted to measure student attainment in determining direction, scale, location, and elevation on maps, reading a grid map, reading horizontal and vertical graphs, and interpreting information from maps and diagrams. Students were tested early in their grade five year on skills which were included in the grade four geography course. Six grade five classes involving one hundred ninety-nine students were chosen from the Avalon North Integrated School District.

A level of 80 percent was selected as being acceptable for each skill area. Attainment of this criterion by students indicated that the skill was part of their repertoire. The results indicated that the students' level of attainment was well below the 80 percent level in all skill areas with the exception of reading a grid map. The analysis of the

[119] R. Pack, "An Assessment of Selected Geographic Skills Attained by Grade Five Students in Newfoundland," (Master's thesis, Memorial University of Newfoundland, 1975).

differences between the mean scores of boys and girls by using a t-test found a significant difference in only one skill area--reading horizontal graphs. This difference was in favor of the girls.

The low achievement by many of the students in Pack's study is indicative of a need for added emphasis on these map reading skills in the social studies curriculum. Arising out of this study, it was thought valuable by this researcher to assess the map reading abilities of Newfoundland students four years later while attending junior high school in order to ascertain their proficiency in selected skills determined to be of central importance to the social studies curriculum. Instead of doing a one-shot assessment, it was felt by this researcher that an instrument which could be used repeatedly by different administrators would be of some value. The provision of norms for the test would also facilitate group comparisons. Thus, the development and standardization of a map reading test for grade nine students was the focus of this study.

Sequencing

Having established that map reading skills are an essential part of the social studies program, teachers, therefore, are faced with the problem of deciding what map reading skills children need and at what grade or experience level certain skills should be taught. This section will shed some light on the literature concerning the sequencing of map skills in the social studies program from primary through to the junior high school grades. The first topic to be addressed, then, is whether textbooks provide an adequate solution to the problem of sequencing.

Hawkins conducted an examination of the map and globe skills in elementary school textbooks.[120] He chose three of the most widely used textbook series in the southeastern United States for analysis. Hawkins examined the map and globe skill component of the eighteen textbooks recommended for first through sixth grades in these three series. The tabulation of his results revealed several common elements in the three textbook series: (1) heavy concentration on the skills for locating specific places, (2) almost complete omission of material on using a map grid in finding directions, (3) emphasis on map key to translate symbols and get information, and (4) general lack of attention to maintaining skills from grade to grade after their introduction.[121] The most significant finding is the last noted, because it implies that there is not a systematic approach in the

[120] M. L. Hawkins, "Map and Globe Skills in Elementary School Textbooks", Journal of Geography, 76 (December, 1977), pp. 261-265.

[121] Ibid., p. 263.

textbooks to the development and maintenance of essential map reading skills.

Askov and Kamm chose a well known and much used social studies textbook series in the United States for the purpose of learning whether map skills are taught and systematically applied at each grade level of the elementary school from grades one through six.[122] They found that map skills were introduced, but only some were systematically developed. Many difficult skills were included in the textbooks for lower grades. Thus, children were required to use skills for which they had not been adequately prepared. The conclusion was reached that little thought had been given in textbooks to the interrelationships among the map skills. Askov and Kamm conclude: "The teaching of the skills has been incidental rather than systematic".[123]

One may note, then, two approaches to the teaching of map skills: (1) a systematic approach, and (2) a needs approach. The systematic approach involves having a well-defined sequence of map skills within which each developing skill is based upon previously mastered skills. Thus, skills would be introduced, developed, and maintained through the various grades of schooling. The needs approach

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[122] E. N. Askov and K. Kamm, "Map Skills in the Elementary Schools", Elementary School Journal, 75 (December, 1974), pp. 112-121.

[123] Ibid., p. 115.

involves a program in which map skills are introduced as they are needed to accomplish certain objectives in understanding certain content.

In developing map skills, then, the teacher cannot rely solely upon a textbook. A textbook can help, but some do not contain enough of the skills or present them in a sequential order. A teacher at the same time cannot depend completely on a good map scope and sequence chart because it does not contain activities for teaching. Both the textbook and the scope and sequence chart should be used (perhaps supplemented by such aids as a map reading kit) together with the students' own surroundings to develop the skills necessary.

What are some of the considerations a teacher must bear in mind when making decisions about the scope and sequence of map reading skills to be introduced and developed? Firstly, skills should be taught within a program whether separate or integrated which provides for systematic development of both skill and knowledge.

The well planned program of map skills should consist of both a scope and a sequence which provide for readiness. Efforts should be made for map concepts to be initially introduced in a concrete way and these should relate to a child's experience. Thus, success may be obtained in teaching map and globe skills by relating the latter to the child's environment first and then by gradually teaching skills as they relate to maps that deal with faraway places. Many skills can be introduced when students are in the early grades, but these skills need to be reintroduced, revised, maintained, and developed through the elementary school, and in the junior and senior high school years.

Teachers must realize that there is yet no "master" scope and sequence chart for map and globe skills. There have been several proposed schemes for depicting the sequence of skills: Rushdoony,[124] Kennamer,[125] Joyce and Alleman-Brooks,[126] Askov and Kamm.[127] One of the more recent sequences is that proposed by Michaelis.[128]

In his textbook for social studies teachers, Michaelis devotes a full chapter entitled "Using Maps, Globes, and Map

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[124] H. A. Rushdoony, "A Child's Ability to Read Maps: Summary of the Research", Journal of Geography, 67 (April, 1968), pp. 213-222.

[125] L. Kennamer, "Developing a Sense of Place and Space", in Skill Development in the Social Studies, ed. H. M. Carpenter, Thirty-third Yearbook of the National Council for the Social Studies (Washington, D.C.: The Council, 1963), pp. 148-170.

[126] W. W. Joyce and J. E. Alleman-Brooks, Teaching Social Studies in the Elementary and Middle Schools (New York: Holt, Rinehart and Winston, 1979), pp. 134-137.

[127] D. N. Askov and K. Kamm, "Map Skills in the Elementary Schools", Elementary School Journal, 75 (December, 1974), pp. 112-121.

[128] J. U. Michaelis, Social Studies for Children in a Democracy (5th ed.; Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1972), pp. 527-534.

Making Activities".[129] He begins by explaining the importance of such concepts as grid systems, cardinal directions, symbols, map scale, and map inference. Then he summarizes the map and globe concepts and skills that should be taught at different grade levels.

Among the skills categories listed by Michaelis are:

(a) directions	(h) area
(b) orientation	(i) globes
(c) distance	(j) location
(d) time	(k) definitions
(e) symbols	(l) comparisons
(f) legends	(m) inferences
(g) scale	(n) map making

The skills are arranged to be taught in a sequence consisting of four levels:

Level I	Kindergarten to Grade 2
Level II	Grades 3 and 4
Level III	Grades 5 and 6
Level IV	Grades 7 and 8

One must be aware, however, that each skill in a map reading sequence chart has a developmental aspect; therefore any sequence can only give a general grade placement.

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[129] J. U. Michaelis, Social Studies for Children in a Democracy (5th ed.; Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1972), pp. 504-550.

MAP PERCEPTION AND CARTOGRAPHIC TECHNIQUES

In this section, the writer will present some basic ideas about the perception of maps and cartographic considerations essential in the making of maps.

The function of a map in the widest sense is communication. The map maker, that is the cartographer, attempts to supply information on the spatial distribution of phenomena. It is his task to present this information adequately. In order to achieve this aim, the cartographer should be aware of the rules and techniques of communication. In the case of this research, the cartographer expertise was provided by a senior cartography major who transformed the rather crude base models of this researcher found in Appendix C into the finer cartographic maps which are contained in Appendix D.

A. Kolancy makes an interesting point when he notes that:

> . . . the creative work of the cartographer should be based on the fullest regard to the needs, interests and subjective conditions of the map user.[130]

This writer approached the development of a map reading test from the point of view of a map user, an educator, rather than from the cartographic point of view of a map

[130] A. Kolancy, "Cartographic Information - A Fundamental Concept and Term in Modern Cartography", The Cartographic Journal, 6 (June, 1969), p. 47.

maker. This researcher's experiences and observations relative to the curriculum, textbooks, and social studies guides of the Province of Newfoundland have influenced the types of maps included in the instrument developed in conjunction with this research.

"A map is a visual instrument in that it transmits information to the eyes".[131] The information that individuals gather from maps, therefore, has a strong visual component. The perception by the individual of data contained in a map may be made effective by the use of colors. However, because of difficulties in the reproduction of color maps and the inclusion of a large number of black and white maps in the textbooks currently in use in the Province of Newfoundland, this researcher decided to use maps containing the colors black and white and shades thereof.

The perception of the visual features on a map is also enhanced if there is a good figure/ground effect.[132] The figure, for example, an island, must be clearly distinguishable from its ground or background, that is, the ocean. Lines to outline shapes and dot patterns were used in the testing instrument to create such a figure/ground effect on many of the maps.

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[131] R. Arnheim, "The Perception of Maps", The American Cartographer, 3 (April, 1976), p. 5.

[132] M. Wood, "Visual Perception and Map Design", The Cartographic Journal, 5 (June, 1968), p. 56.

Maps consist of elements that generally may be classified under four headings: areas, lines, points, and names.[133] The distribution of a feature may be suggested by outlining the boundaries of an area and applying an appropriate pattern to that area. The dot patterns, with uniformly sized dots arranged in rows, was selected for the maps developed for this study. This is a common pattern style found in many textbooks.

Jenks and Knos suggest this type of area shading ". . . may be used for emphasis, to differentiate kind, or to show varying intensities of the same distribution".[134]

An example of a pattern being used for emphasis would be the highlighting of a coastline by applying a tone either to the land or water area. Patterns in an ordered series of tones may be used for maps of quantitative distributions such as amount of rainfall or elevation above sea level.

Lines are generally employed in a map to join points or to separate areas. Wood believes that the lines on a map should stand out enough so that they can be easily traced.[135]

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[133] M. Wood, "Visual Perception and Map Design", The Cartographic Journal, 5 (June, 1968), p. 59.

[134] G. F. Jenks and D. S. Knos, "The Use of Shading Patterns in Graded Series", Annals of the Association of American Geographers, 51 (September, 1961), p. 317.

[135] M. Wood, op. cit., p. 60.

Lines may be used to separate land and sea areas for instance.

Points are really one of many types of symbols used on maps. They may be used to depict physical objects or "associated ideas at specific locations",[136] for example, the location of a town.

Imhof suggests some general principles and requirements to be considered in the placement of names of maps.[137] Among the guidelines he recommends are the following:

> 1. The names should . . . be easily read, easily discriminated, and easily and and quickly located.
> 2. The name and the object to which it belongs should be easily recognizable.
> 3. Names should disturb other map contents as little as possible.
> 4. Names should assist directly in revealing spatial situation, territorial extent, connections, importance, and differentiation of objects.
> 5. Type arrangement should reflect the classification and hierarchy of objects on the map.
> 6. Names should not be evenly dispersed over the map, nor should names be densely clustered. Here name selection and name arrangement are important.[138]

For students to obtain the necessary information contained in symbolic form on many maps, a map legend is an

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[136] M. Wood, "Visual Perception and Map Design", The Cartographic Journal, 5 (June, 1968), p. 61.

[137] E. Imhof, "Positioning Names on Maps", The American Cartographer, 2 (May, 1975), pp. 128-143.

[138] Ibid., pp. 129-130.

essential element. Wood points out to the map maker that:

> Although some conventions exist in maps the symbols are not as standardized as they are in written language, and a legend is always required for each map to allow for complete interpretation.[139]

The particular orientation of a map must also be indicated. Arnheim suggests that, "Customarily, maps are laid out along the cardinal directions of the compass rose".[140]

In conclusion, it is the map maker's task to attempt to come to some kind of compromise between reality and the kind of symbols and conventions on a map that facilitate the ability of the individual to perceive that which the map represents. He must attempt to include details without making a map that is so cluttered that it is impossible to grasp the essential elements required for understanding the map's fund of information.

SUMMARY

On the basis of the empirical research and related literature reviewed in this chapter, a number of generalizations may be made. First, the review of literature and research seems to indicate that the growth of children in

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[139] M. Wood, "Visual Perception and Map Design", The Cartographic Journal, 5 (June, 1968), p. 57.

[140] R. Arnheim, "The Perception of Maps", The American Cartographer, 3 (April, 1976), p. 7.

map reading skills tends to correspond roughly to learning and cognitive development theory. The literature reveals that the development of map reading skills is viewed as an integral part of the social studies program. Second, the research indicates generally a lack of proficiency in map reading skills in elementary and junior high school students. Third, some researchers have shown that when students are given a program of systematic instruction in selected skill areas, they have shown significant achievement gains. Fourth, some researchers have indicated that selected skills may be introduced at lower grades than was previously thought. Fifth, most researchers seem to indicate that the incidental teaching of map reading skills including directions has failed. Sixth, the lack of proficiency in map reading skills of school students has caused some researchers to call for a more systematic approach to the teaching of those skills which can be mastered by students at various grade levels. Seventh, the measurement of map reading skills requires the use of valid and reliable testing instruments sensitive to the objectives of the social studies program of a region.

This chapter has presented the observations of some researchers in relationship to individuals' perceptions of maps. The cartographers use of various cartographic techniques has also been discussed briefly.

As stated earlier, the development of map reading skills generally falls mainly within the responsibility of the geography program. There is an opportunity for geographic education to commence in the primary grades and certainly provision for geography is recognized as an integral part of the social studies curriculum of the Province of Newfoundland. Yet, a study by Jones in 1978, part of which concerned the teaching of geography in this province, indicated that the main mode of instruction in geography was expository.[141] Ninety-six percent of the teachers in the study indicated that maps and globes were used in the classroom. Seventy-two percent of the teachers used charts and graphs. A critical factor, the extent of use of maps and globes in the classroom by the teacher and/or students, was not indicated, however. If the use of these materials is by the teachers, then this would indicate a lack of opportunity for students to be actively involved in the development and learning of the required map reading skills. Active student participation was certainly a major facet of learning theory and cognitive development theory as well.

In light of these revelations, the question may then be raised: What is the status of map reading skills

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[141] F. G. Jones, Geography Teaching in Canadian Schools (St. John's, Newfoundland: Memorial University of Newfoundland, 1978).

possessed by students in the junior high school grades in Newfoundland? This study was concerned with the development of an instrument useful for determining the attainment of beginning grade nine students in a selection of map reading skills relevant to the social studies program of this province.

CHAPTER THREE

TEST DEVELOPMENT PROCEDURES

Introduction

It is the purpose of this chapter to outline in some detail the test development procedures which were considered in the development of the map reading test that is the focus of this study. The relationship of the test to the school curriculum of Newfoundland and Labrador will be discussed prior to the consideration of such factors as the formulation of the objectives for the test, the test plan, the writing and analysis of items, as well as the establishment of the test's validity and reliability.

The concept of "test" is central to this study and therefore a definition of this term will serve as an introduction to the remainder of this chapter. There are many ways in which a test may be defined, but a particularly useful definition has been suggested by Brown. He defines a test as, "a systematic procedure for measuring a sample of behavior".[142]

The definition, though brief, has many implications. First, the idea of a "systematic procedure" indicates that there are prescribed rules for the construction,

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[142] F. G. Brown, Principles of Educational and Psychological Testing (New York: Holt, Rinehart and Winston, 1976), p. 7.

administration, and scoring of the test. Test items then must be chosen in a systematic fashion so as to correspond to the plan laid down for the test. The same items are administered to all persons, and the directions and the time limits are the same for all persons taking the test. The use of predetermined rules for scoring responses to test items assures agreement between different persons who might score the test.

A second important element in the definition is behavior. Their responses to test items reflect the underlying characteristics of the students. Therefore, the test items must be good measures of the underlying skills, knowledge, or attitudes possessed by the takers.

A test contains only a sample of all possible items that could be written. No test is so comprehensive and all-inclusive that it includes every conceivable item that might be developed to measure a specific behavior. Thus, a test is really a chosen selection of carefully constructed items. In view of the fact that a test only contains a sample of all possible items, efforts must be made to ensure that the items included on the test are a representative sample of such items.

TEST DEVELOPMENT PROCEDURES AND THEIR RELATIONSHIP TO THE TEST INSTRUMENT

There are many considerations to be judged by the test constructor in the development of a test. Some of these theoretical and practical procedures will be discussed in this section of the chapter. The basic discussion focuses on many of the ideas presented by Frederick Brown in his text Principles of Educational and Psychological Testing.[143]

In the process of test development, the test constuctor is presented with two basic problems: first, to determine the content of the test, and second, to determine its format. Thus, this test constructor had to ascertain what skills the test would cover and how the test items would be presented.

In deciding what the content of the test will be the test maker must answer the question, "What are the intended uses of the test?" Tests may be used for selection, placement, diagnosis, or for other purposes. Each purpose has a direct bearing on the type of content chosen and its organization in the test instrument. This study was concerned with the development of an instrument which may be used to measure the attainment of students who are enrolled in grade nine in the schools of Newfoundland and Labrador in selected map reading skills.

In relationship to the format of the test, the test constructor might ask himself the question, "What group will take the test?" The instrument under consideration in this research was developed for Newfoundland students at the

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[143] F. G. Brown, Principles of Educational and Psychological Testing (New York: Holt, Rinehart and Winston, 1967), p. 7.

beginning of grade nine who possess a variety of intellectual levels, reading levels, chronological ages, and who come from a variety of different socio-economic backgrounds. The large majority of test takers it was assumed would be of "average" intelligence and would be from fourteen to fifteen years of age.

In proceeding with the development of the test, the test constructor, having decided on the purpose for his test, must decide on the content and/or skills that the test will cover. To specify the coverage of a test, it is most advisable that a test plan be constructed. A test plan is simply a table showing the topics or skills to be covered by a test, along with some indication of the relative emphases to be given to each content-skill category. The plan may also serve as an outline to guide the writing of objectives. The skill areas serving as the focus of this study were those dealing with the students' use and understanding of directions, locations, elevation, scale, grid systems, and map interpretation. The test plan developed for the purposes of this study may be found in Appendix A.

The test constructor having decided on the content to be covered must also determine the manner in which the test items will be presented. Some common test formats are: the speed versus power test, the alternative versus free response type of items, the paper and pencil versus the performance test, and the group versus the individual administration test.

For the purpose of this study, this researcher decided to combine several of these components. The testing instrument developed was a pencil and paper test containing alternative response items and it was designed for group administration. The rationale underlying the choice of this type of test will be discussed later in this chapter.

Having made the preliminary decisions relative to the content and format of the test, the test constructor then proceeds to write the test items. The process of developing good items is one of writing, editing, trying out, and revising. Items that survive the initial screening are assembled in a pretest. This pretest is then administered to a sample of people similar to those who will take the completed test. Data are thus acquired about how the students on the pretest reacted to the test items. The analysis of the pretest scores involves calculation and interpretation of item difficulty and item discrimination indices. Data are also sought on how effective each distractor on each test item is in attracting responses. The appropriate item tryout of the map reading test serving as the focus of this study was conducted by choosing a sample of forty-nine students, two grade eight classes, from whom to obtain pretest data. These data were then subjected to the appropriate analysis. When the test constructor was satisfied that all necessary item analyses had been completed and revisions made, those items that (1) provided the best discrimination, (2) were of appropriate difficulty, and (3) had no weak alternatives and no ambiguities were chosen for inclusion in the final form of the test. (See the subsection on Item Analysis in this chapter.)

In order to complete the process of test standardization, a number of elements must be present. First, a common set of items must be administered to all students. This procedure allows a comparison of students' performance on the test. Second, the test must be administered under the same testing conditions to ensure that scores are comparable. Thus, the test developed by this researcher prescribed directions for administering the test and standard time limits. A test manual was developed to accompany the test and includes all relevant information necessary for test administration. Third, the need for objectivity in scoring was met by the format suggested for the testing instrument. By using multiple choice items, there would be a high degree of agreement between two or more scorers who correct the students' responses to the test items.

In considering the design of a testing instrument and its use to collect data relative to student achievement, there are another three factors that are of central importance to the interpretation of a test's results. These factors are validity, reliability, and normative data.

Reliability of a test deals with how consistently a test measures. How accurate are the scores? Validity is concerned with the extent to which a test measures what it is designed to measure. The test scores of a test give an indication of how well a student is performing in various skill areas. However, often those who administer tests want to compare an individual's score with the scores of others who have taken the test and by doing so an indication of the student's relative performance can be ascertained by using norms. These three final concepts shall be developed further in a later section of this chapter.

RELATIONSHIP OF SCHOOL CURRICULUM IN NEWFOUNDLAND AND LABRADOR TO THE TEST

Perhaps the single most important aspect of any achievement test is the test's validity. Does the test measure what it is designed to measure? For the purposes of this research, the question to be raised is, "Does the map reading test measure map reading skills that are purported to be a part of the social studies curriculum available to Newfoundland students?"

In order to ensure the content validity of the map reading test, this test constructor has referred to three major sources of information for the development of the objectives which the test items will purport to assess. The three sources of information are: (a) the geography textbooks presently used in grades four, five, six, seven, and eight, (b) a Newfoundland Department of Education booklet entitled Map and Globe Skills, K-7[144] which contains a list of skills and understandings and suggested grade levels for their introduction and/or development, and (c) a Newfoundland Department of Education publication entitled Design for Social Studies, K-VI in Newfoundland and Labrador[145] which includes among its suggested major understandings, values, and skills at each grade level, an outline of map and globe skills.

In the Province of Newfoundland, the formal study of geography begins in grade four, the approach in the primary grades being more informal and being termed the Primary Social Studies Program. In this primary division provision is made for the geographic education of primary grade children--depending on the teacher and the emphasis he places on this aspect of the program.

The grade four text, Around Our World - A Study of Communities,[146] introduces the child to a study of the world by

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[144] Division of Curriculum, Map and Globe Skills, K-7 (St. John's, Nfld.: Department of Education, n.d.).

[145] Division of Curriculum, Design for Social Studies, K-VI in Newfoundland and Labrador (St. John's, Nfld.: Department of Education, n.d.).

[146] D. L. Massey, ed., Around Our World - A Study of Communities (Toronto: Ginn and Company, 1965).

taking him on an imaginary trip to eight regional areas of the world community. Throughout this imaginary journey emphasis is placed not only on a study of regions, but also upon the relationship of the physical environment to ways of living in the world community. The introductory chapter serves as a study of the home and neighborhood community. The text in preparing the child for the more formal study of geography contains numerous maps and a "Map Shop", the purpose of which is to show pupils how to read maps.

Geography of Newfoundland,[147] the grade five text, is concerned with the students' study of their own province. The text focuses on having the student understand what Newfoundland is like--its people, its resources, its industries, and how geographic factors influence living in various areas of Newfoundland. A Teaching Guide for Social Studies, Grades K-6 for 1973-74[148] outlines more specifically the role of maps in the text.

> A student should gain skill in using maps and globes effectively in dealing with problems of area, location, distance, elevation, density of population, travel routes, products, rainfall, vegetation, and the relationships between surface features and living conditions.[149]

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[147] W. Summers and M. Summers, Geography of Newfoundland (Toronto: Copp-Clark, Ltd., 1972).

[148] Division of Curriculum, A Teaching Guide for Social Studies, Grades K-6 for 1973-74 (St. John's, Nfld.: Department of Education, 1973).

[149] Ibid., p. 14.

A deepening understanding of the various geographic areas and of the people who live in the other regions of Canada is central to the grade six text, Canada: This Land of Ours.[150] An equally important idea developed in the text is that all Canadians have the same basic needs. The text is written with what the authors call a non-traditional "organic approach". That is, studies of climate, vegetation, soil, landforms, and population density are introduced where each has significance, rather than repeated in regular order chapter after chapter.

Introducing Earth, Part I[151] and Introducing Earth, Part II[152] are intended to give a picture of the main regions and peoples of the world. These grade seven and eight texts stress the way people live, the problems presented by certain types of environments, the earlier methods of coping with them and the further problems created by the impact of western civilization and technology upon the way of life of other people. The new metric editions of the text contain supplementary skills sections which serve as an introduction.

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[150] W. Wiley, et al., Canada: This Land of Ours (Toronto: Ginn and Company, 1976).

[151] L. F. Hobley, Introducing Earth - Part I (Toronto: Macmillan Company of Canada, Ltd., 1979).

[152] L. F. Hobley, Introducing Earth - Part II (Toronto: Macmillan Company of Canada, Ltd., 1979).

Throughout grades four to eight, the areas of study in the geography books are generally identified through a fairly extensive use of maps: rainfall, temperature, physical features, vegetation, industry, transportation, and population. Many of the maps are in color and some contain information about one concept only.

The maps used throughout the texts serve basically two purposes: (a) the clarification of material in the text, and (b) the addition of new material. A quantitative measure can be ascertained as to the actual number of maps contained in each of the textbooks discussed above. This will provide some rough measure of the extent to which textbook publishers have made provision for map study. The table below gives the total number of textual pages in each test, the number of maps in each book, and an approximate ratio of the number of maps to textual pages.

Table 1

Map Census of Grades Four, Five, Six, Seven and Eight Textbooks

Grade	No. of Maps	No. of Textual Pages	Ratio of Maps to Textual Pages
IV	56	207	1:4
V	37	182	1:5
VI	62	225	1:3.5
VII	155	262	1:2
VIII	140	254	1:2
Total	450	1130	1:3

Naturally, there is great variation in the nature and complexity of the maps contained in the various texts. Using these basic data in Table 1, the reader can note a few interesting points. For instance, in grade four on average a student comes in contact with some form of a map on about every fourth page, in grade five every fifth page, in grade six on every three and a half pages, in grade seven every second page, and in grade eight every second page. It is important to note, however, that the mere insertion of maps and their correlation with a text is not enough. Maps need to be used constructively and systematically by all students in successive grades if they are to develop proficiency in map reading skills.

A greater degree of relationship between the array of textbook material and this researcher's map reading test is established when reference is made to The Master Guide for Social Studies, K-XII.[153] This document states that the overall goal for the social studies program for the schools of Newfoundland and Labrador is the formation of the "person-citizen". This publication places emphasis on the two-fold nature of the overall goal describing it as:

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[153] Division of Curriculum, The Master Guide for Social Studies, K-XII in Newfoundland and Labrador (St. John's, Nfld.: Department of Education, n.d.).

> (1) Person-centered. The Social Studies [sic] should help the learner to find meaning in life situations and in human relationships, to be self-accepting and other-accepting as he develops in ways of knowing, thinking, feeling, valuing, and intelligent behavior.
> (2) Citizen-centered. The Social Studies [sic] should help prepare the person citizen to participate effectively in the changing life of the democratic society of which he is a member.[154]

The Master Guide for Social Studies, K-XII has identified central elements that are instrumental in achieving successful attainment of this goal. These are major understandings, values, thinking processes and related skills, reflective thinking, related language and social studies skills. The document recognizes three major categories of related social studies skills as being essential to the social studies program from kindergarten to grade twelve. They are: (1) critical and creative thinking, (2) democratic group participation skills, and (3) information gathering skills. Listed under the heading of information gathering skills are:

> listening, observing, reading, questioning, library usage, and the use of curriculum resources, e.g., textbooks, maps, globes, films, and graphic material.[155]

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[154] Division of Curriculum, *The Master Guide for Social Studies, K-XII in Newfoundland and Labrador* (St. John's, Nfld.: Department of Education, n.d.), p. 12.

[155] Ibid., p. 24.

In emphasizing the importance of these skills, The Master Guide for Social Studies, K-XII notes that:

> All . . . skills . . . must be developed through the grades, Kindergarten through Grade XII. It will be the responsibility of subsequent level guides to delineate the skills in a grade by grade sequence. . . .[156]

One of the subsequent guides developed to outline these skills in a grade-by-grade sequence is the publication entitled Design for Social Studies, K-VI.[157] This document is a direct outgrowth of the "goal referenced" approach of The Master Guide for Social Studies, K-XII. Such an approach places great emphasis on stating goals and objectives in the form of expected outcomes for learners.

> In Design for Social Studies, K-VI goals (areas of emphasis) and objectives . . . direct the order and sequence of instruction because they indicate what skills are needed to complete each successive level of instruction and which content and skills precede them. . . .[158]

Design for Social Studies, K-VI treats each grade level systematically from kindergarten to grade six in the following manner: (a) an introductory statement about the growth and development of the 'typical' student at that age level, (b) an

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[156] Division of Curriculum, The Master Guide for Social Studies, K-XII in Newfoundland and Labrador (St. John's, Nfld.: Department of Education, n.d.), p. 16.

[157] Division of Curriculum, Design for Social Studies, K-VI in Newfoundland and Labrador (St. John's, Nfld.: Department of Education, n.d.).

[158] Ibid.

outline of the objectives for the social studies curriculum in Newfoundland at that grade level under the three general headings of knowledge, values, and skills, (c) a list of suggested learning activities, and (d) a comment on pupil evaluation.

Design for Social Studies, K-VI is careful to emphasize that evaluation is a continuous and integral part of the social studies curriculum.

> When knowledge, values, and skills objectives have been stated, an effective program of evaluation can be developed that is comprehensive and cumulative, and open to many instruments and devices for assessing pupil growth.[159]

The Master Guide for Social Studies, K-XII more specifically defines evaluation in the social studies as:

> . . . the method or methods used to determine the extent to which previously established goals and purposes have been achieved.[160]

This researcher notes at this point that the skill objectives as outlined in the Design for Social Studies, K-VI could be classified as general objectives rather than behavioral objectives. These objectives serve, however, to give stability and continuity to the social studies program from kindergarten to grade six and thus help to lay the foundation

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[159] Division of Curriculum, Design for Social Studies, K-VI in Newfoundland and Labrador (St. John's, Nfld.: Department of Education, n.d.), p. ix.

[160] Division of Curriculum, The Master Guide for Social Studies, K-XII in Newfoundland and Labrador (St. John's, Nfld.: Department of Education, n.d.), p. 48.

for the social studies in the junior high grades. It is possible to translate these general objectives into more specific instructional objectives for classroom use by the teacher. Given the general objectives, one may assume that there can be developed an evaluation instrument that would be useful to teachers in the assessment of their students' progress in attaining the skill objectives as outlined in The Design for Social Studies, K-VI.

More specificity can be added to the nature of the skills to be developed, especially in map reading, if one refers to another Newfoundland Department of Education publication entitled Map and Globe Skills, K-7.[161] The nature of this booklet is highly complementary to the Design for Social Studies, K-VI as it pertains to map reading skills. Map and Globe Skills, K-7 is meant to serve as an instructional aid for use in the study of geography. Its stated purpose is to provide for:

> . . . a developmental sequence from grade to grade of skills and understandings through defining broad skill areas.[162]

The booklet may be viewed as providing a framework for teachers from which pupils may be guided to learn the

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[161] Division of Curriculum, Map and Globe Skills, K-7 (St. John's, Nfld.: Department of Education, n.d.).

[162] Ibid., p. 1.

language and skills necessary for reading maps and globes. Among the topics dealt with in the booklet are: direction-orientation, location, scale, distance, symbols, and use-interpretation.

The textbooks used in the social studies program and the content of both the Design for Social Studies, K-VI and Map and Globe Skills, K-7 are certainly not absolutes. These courses are all subject to revision, perhaps even replacement. Textbooks particularly have a tendency to "come and go". The Design for Social Studies, K-VI, however, is the result of a recent revival of interest in social studies in the Province of Newfoundland. It is the result of four years of deliberation by a provincial committee to revise the social studies curriculum. It can then surely be assumed to be a reflection of current common thoughts and trends and is, therefore, of central importance to the social studies program in place in Newfoundland at the present time and in the forseeable future. Map and Globe Skills, K-7 should certainly be viewed as a most useful supplementary source which highly complements the map skills outlined in Design for Social Studies, K-VI. Because the content of textbooks has a tendency to change rapidly over time, the social studies skills of map reading may be seen as more stable and long lasting. The importance of these skills led this researcher to institute this study, the purpose of which was to develop and standardize a test of map reading skills using for guidance primarily the three sources of information discussed in this section. The review of research and related literature as well as the theoretical considerations discussed in chapter one also served to guide the efforts of this researcher. The information gained from the administration of such a test will be useful in reflecting the extent to which social studies students in Newfoundland are successful in developing those relevant map reading skills outlined in the objectives of the social studies curriculum for that province.

RATIONALE FOR SPECIFIC TEST DESIGN

In an earlier section of this chapter it was stated that the intended task of this researcher was to develop a pencil and paper test containing alternative response items designed for administration to a group of students. The rationale for adopting such a specific test design will be outlined in the following paragraphs by comparing the chosen design with other possible formats and by citing the advantages of the design selected to meet the purpose of the study undertaken.

In order to obtain a measure of a student's behavior on a test, two basic formats can be used--a paper and pencil test or a performance test. The distinction lies in how the test items are presented and responses made. Performance tests often require students to manipulate some object or apparatus. They are usually administered individually so that the examiner can count the number of errors committed by the student and so that he can measure how long it takes the respondent to complete each item. These types of tests tend to be very time consuming and require a one-to-one correspondence of tester to testee. Administration of these tests generally requires that the examiner have much training and experience.

For the purpose of this research, a group administered paper and pencil test was deemed to be most appropriate. The students were given written questions to answer and they responded by writing their answers on paper. Thus, this type of test could be administered to a large number of persons at a time (a whole class, for example). The examiners did not need the same degree of training and experience that would have been required had they been administering performance tests. The examiners had to be careful, however, to follow the test administration directions outlined in the test manual. Thus, pencil and paper tests are economical in the sense that for a given period of time measures of student behavior can be obtained on a relatively large sample of students.

Tests may also be classified on the basis of whether they emphasize power or speed. In a speed test, for example, the items are usually very simple, but there is a very strict time limit. The items are so easy that few students are expected to make errors. However, only the very best students are able to complete the examination within the time limit.

Thus, a student's score on a speed test is an index of speed of response.

This researcher favored the power test. A power test has generous time limits so that most students are able to attempt every item. A power test, however, is composed of items of varying difficulty. The test demonstrates how much knowledge or information a person has. Thus, the score on a power test reflects the level of difficulty of items that a student can answer correctly.

The variety of possible test item types that are available for consideration can be classified under the two general headings of free response and alternative response items. In free response items, the test taker supplies a response such as in completion, short answer, or essay questions. On an alternative response item, the test taker selects the appropriate response from among several alternatives, as in multiple-choice, true-false, or matching items. Each of these types of test items has both disadvantages and advantages. It is unneccessary for these to be listed for each type. It is important, however, to outline some advantages of the multiple-choice type which had been chosen as the format most appropriate for this research study.

First, multiple-choice items can be used to measure a variety of learning outcomes from the simple rote knowledge level to the more complex levels. This, of course, depends upon the skill of the item writer. Second, since student writing is minimized, the teacher can sample a substantial amount of subject matter content or skills in a relatively short period of time. Third, the scoring is considered to be more highly objective and reliable than is the marking of essay tests. For instance, scorer inconsistencies often account for a portion of the unreliability of scores on essay tests. On objective tests, scoring is highly objective since little interpretation is needed to count the number of correct responses. If disagreement should arise as to which is the "correct" answer, often this problem can be remedied by careful editing and pretesting of test items. Fourth, it is relatively economical in terms of time required to score an objective test by comparing item responses to a prepared answer key. Fifth, because multiple-choice items have three, four, or five options, they reduce the effects of guessing compared to other test item types such as true-false items. Finally, the multiple-choice type of format is particularly suitable for item analysis, for detecting areas of student weakness, for gaining evidence of item ambiguity, for compiling estimates of item difficulty, and for ascertaining the degree to which an item discriminates between the more able and less able students in a group.

The advantages discussed above are the reasons underlying the rationale for the adoption of the specific test design that was chosen as the format for the test of map reading skills.

DEVELOPMENT OF MAP READING TEST

Having outlined the rationale for the test design and the relationship of the test to the school curriculum, this researcher will now focus attention on some of the more specific aspects of the development of the testing instrument.

Behavioral Objectives

The importance of instructional objectives has been emphasized by Noll and Scannel when they stated:

> Definition of goals comes first--as it must if teaching is to have purpose and direction. To try to teach and evaluate without defining objectives is like starting out on a journey without knowing where you want to go. It may be pleasant to wander around for a while, but it is doubtful that any sort of progress can be made without some direction.[163]

The important relationship between objectives and evaluation is pointed out by Gronlund:

> Educational objectives encompass a variety of learning outcomes. . . . Evaluation includes a variety of procedures. . . . The key to sound evaluation is to relate the evaluation procedures as directly as possible to the specific learning outcomes being evaluated.[164]

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[163]V. Noll and D. Scannel, Introduction to Educational Measurement (Boston: Houghton Mifflin Company, 1972), p. 166.

[164]N. Gronlund, Measurement and Evaluation in Teaching (New York: The Macmillan Company, 1971), p. 57.

It may be readily seen, then, that evaluation is an integral part of teaching and learning. Evaluation is a comprehensive process. In an effective educational program objectives have to be identified. It is advisable that the objectives be specified in terms of specific learning outcomes on behalf of the student. Once this has been done, the final step in the evaluation process is more readily accomplished.

> . . . to select or develop evaluation instruments which provide the most direct evidence concerning the attainment of each specific learning outcome.[165]

In educational literature, educational objectives have been described as being process or product, behavioral or implicit, immediate or ultimate, and restricted or inclusive to list but a few of the adjectives that have been used. It is not germane to this study to explore the variety of meanings attached to these terms. This researcher favors the term behavioral objectives for the purpose of this study.

Behavioral objectives specify an observable task or "terminal behavior" that the student must perform to demonstrate that the educational goal has been attained. In their most complete form, behavioral objectives contain

[165] N. Gronlund, Measurement and Evaluation in Teaching (New York: The Macmillan Company, 1971), p. 57.

three elements according to Robert Mager:

> (1) A terminal behavior or overt activity to be performed by the student.
> (2) A specification of the conditions under which the terminal behavior is manifested.
> (3) A minimum level of acceptance.[166]

Under some conditions it may not, however, be necessary to specify the minimum level of acceptance performance. Sax makes the point when he notes:

> Nor is it always necessary to specify a minimal 'passing' score. On norm referenced tests, for example, there may be no minimum level specified in advance. Instead, such tests are designed to measure individual differences and 'passing' is often a function of how well others performed on that test. Furthermore, what constitutes mastery varies greatly from task to task and perhaps from student to student.[167]

The development of the testing instrument on map reading skills was aimed at an assessment of behavioral objectives. These statements of objectives were formulated primarily from the three sources discussed earlier in this chapter. A statement of objectives is provided in Appendix B.

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[166] R. Mager, Preparing Instructional Objectives (Palo Alto, California: Fearon Publishers, Inc., 1962), p. 52.

[167] G. Sax, Principles of Educational Measurement and Evaluation (Belmont, California: Wadsworth Publishing Company, Inc., 1974), p. 52.

Test Plan

The process of evaluation, as outlined earlier, is concerned with a great deal of correspondence between the objectives of a course and the objectives assessed by particular test items. In order to ensure a clear relationship between the two, a test plan is a useful tool. The test plan found in Appendix A lists the skill areas to be assessed by the test. It also contains a projection of the approximate number of test items to be used to test each skill area. The complexity of the skill in terms of its level of proposed development in curriculum guides and texts is the basic criterion for allotting specific numbers of test items to particular skill areas. For example, the more complex skill area of map interpretation is assigned a larger number of test items than the skill area of determining location.

Item Writing

The type of test item chosen for the map reading test was the multiple-choice item. The multiple choice item consists of a stem, which presents a problem situation, and several alternatives, which provide possible solutions to the problem. The stem may be a question or an incomplete statement. The alternatives include the correct answer and several plausible wrong answers called distractors. Their purpose, of course, is to distract those students who are uncertain of the correct answers.

In the writing of test items for the map reading test, the test developer wanted to present students with a task that was both important and clearly understood, and one that could be answered correctly only by those who had achieved the desired learning. Guidance towards achieving this aim was provided by a set of rules for construction of multiple-choice items that has been proposed by Norman Gronlund. Other sets of rules are very similar and overlap those below. The rules outlined by Gronlund are:

(1) Design each item to measure an important learning outcome.
(2) Present a single, clearly formulated problem in the stem of the item.
(3) State the stem of the item in simple, clear language.
(4) Put as much of the wording as possible in the stem of the item.
(5) State the stem of the item in positive form wherever possible.
(6) Emphasize negative wording whenever it is used in the stem of an item.
(7) Make certain that the intended answer is correct or clearly best.
(8) Make all alternatives grammatically consistent with the stem of the item and parallel in form.
(9) Avoid verbal clues which might enable students to select the correct answer or to eliminate an incorrect alternative.
(10) Make the distractors plausible and attractive to the uninformed.
(11) Vary the relative length of the correct answer to eliminate length as a clue.

(12) Avoid use of the alternative 'all of the above' and use 'none of the above' with extreme caution.
(13) Vary the position of the correct answer in a random manner.
(14) Control the difficulty of the item either by varying the problem in the stem or by changing the alternatives.
(15) Make certain each item is independent of the other items in the test.
(16) Use an efficient item format.[168]

Although these sixteen rules are stated in the form of absolute statements, there were cases during item writing when changes or modifications were desirable. However, close adherence to these sixteen rules ensured test items of a fairly high quality.

In preparing test items, it was also desirable to prepare more items than the test plan called for, since defects in some items became apparent after later analysis. The extra items made it easier to maintain the distribution of items reflected in the test plan.

Assembling the Test

Arranging the Items

From a pool of test items written by this test developer, a selection of those most appropriate and free from obvious defects where chosen for inclusion in a tryout

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[168] N. Gronlund, Constructing Achievement Tests (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1968), pp. 39-44.

of test items. When the selection had been made, they were then ready for assembling in a test. Gronlund suggests that:

> (a) the items should be arranged in order of difficulty, or
> (b) for some purposes, it may be desirable to group together items which measure the same learning outcomes or the same subject matter.[169]

The nature of the map reading skills under study was such that the testing of the skills had to be tied to the presentation of maps. Therefore, questions concerning various skills had to be grouped together as they were relevant to the material contained in the map or maps. There was, however, an attempt made to arrange material so that the easier test items were located toward the beginning of the test and the more difficult items were placed towards the middle and end of the test. Data on actual difficulty levels of test items were more readily available after an initial tryout of the test and item analysis had been completed.

Directions for the Test

The directions for the achievement test were relatively simple and indicated: (a) the purpose of the test,

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[169] N. Gronlund, Constructing Achievement Tests (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1968), pp. 39-44.

(b) a sample question, and (c) the method to be followed by the students in recording their answers.

Test Booklets

When the test had been arranged in a suitable sequence, the test items and directions were assembled together in a test question booklet. Each student marked his answers in a test question booklet. A separate booklet containing the maps accompanied the question booklet.

Test Manual

To accompany the map reading test, a manual was written which provided complete directions for administering the test. Detailed instructions were provided for both the students and test administrators. The test manual in its final revised form includes information on such matters as:

(1) A description of the test, its purpose and application;

(2) time limits;

(3) seating arrangements;

(4) methods of correcting errors on answer sheets;

(5) method of distributing and collecting test materials;

(6) procedures for correcting and scoring answer sheets;

(7) a description of the sample used for norming purposes;

(8) a table of test norms arrived at by converting raw scores to percentile ranks;

(9) a statement of the sources used as references for test content validation;

(10) a statement of objectives assessed by the test;

(11) a statement about test reliability.

The purpose of including such information, of course, is to facilitate test administration and interpretation.

Administration of Form I of the Map Reading Test

The seventy item map reading test (see Appendix D) developed for the purposes of this study was initially administered to two grade eight classes under the jurisdiction of the Roman Catholic School Board for Conception Bay North. The test was administered by the teacher of each class during the first week of June, 1983. It is assumed that eacn teacher followed the administration procedures as outlined in the teacher's manual found in Appendix F.

The completed tests were collected by this researcher who then proceeded to score the individual test items for each student. Data were thus available for a group of forty-nine students. The mean raw score for this group was 43.87 rounded to 44. The standard deviation of the test scores was 11.67. The median score was 44 and the mode was 48.

Table 2 summarizes the characteristics of the test trial group.

Table 2

Trial Group Characteristics

Grade	No.	Sex		Age in Years			
		M	F	13	14	15	16
8	49	23	26	21	23	3	2

Item Analysis

The student responses were subjected to an item analysis which focused on determining for each test item: (1) the difficulty level, (2) the index of discrimination, (3) the effectiveness of each distractor. The item analysis procedures discussed in the following sections are those outlined by Gronlund,[170] Sax,[171] and Hopkins.[172]

In order to conduct the item analysis, the forty-nine test papers were arranged in order from the highest score to the lowest score. Approximately 27 percent of the

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[170] N. E. Gronlund, Constructing Achievement Tests (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1968), pp. 85-88.

[171] G. Sax, Principles of Educational Measurement and Evaluation (Belmont, California: Wadsworth Publishing Company, Inc., 1974), pp. 182-207.

[172] C. Hopkins and R. Antes, Classroom Testing Construction (Itasco, Illinois: F. E. Peacock Publishers, Inc., 1979), pp. 148-164.

papers with the highest scores were selected and called the upper group.[173] Twenty-seven percent of the papers with the lowest scores were selected and called the lower group. Thus, each group consisted of thirteen papers. The item analysis was based on these twenty-six papers. The other twenty-three papers were placed aside and not referred to during the item analysis.

The unavailability of computer expertise and techniques for analysis of the seventy item test was rectified for the administration of the revised test in its final form for the purposes of this thesis research. Access to a computer consultant and statistical package, the Statistical Package for the Social Sciences,[174] has made it possible to include data that would be valuable for a further revision of the map reading test. These data are presented in Appendix P.

(a) Item p values (difficulty levels) for the total sample are included. The difficulty level of an item (p) may be viewed as the proportion of students responding correctly to it. The higher this proportion is, the easier the item is. The maximum value of p, + 1.0, occurs

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[173] G. Sax, Principles of Educational Measurement and Evaluation (Belmont, California: Wadsworth Publishing Company, Inc., 1968), p. 88.

[174] N. H. Nie, Statistical Package for the Social Sciences (2nd ed.; New York: McGraw-Hill, Inc., 1975).

whenever everyone responds correctly; the lowest value of p, 0, means that everyone missed the item.

(b) Also in Appendix P are the item point-biserial correlations (discrimination indices).

(c) Distractor effectiveness data are provided in the form of a division of the total sample group into quarters based on total scores accompanied by a tabulation of the number of students choosing each distractor in each criterion group.

The further revision of this test is beyond the scope of this present research study, but the presentation of the data in Appendix P may facilitate a subsequent refinement of this evaluation instrument.

Item Difficulty

Table 3 presents a frequency distribution of item difficulty levels based on the seventy item test. The reader should note that fifty-seven of the test items fell between a 20 and 78 percent difficulty level.

Table 3

Distribution of Difficulty Levels on Form I Test Items

Percentage Difficulty	Number of Items at Each Level
90 - 99	2
80 - 89	10
70 - 79	9
60 - 69	17
50 - 59	17
40 - 49	8
30 - 39	6
20 - 29	0
10 - 19	1
0 - 9	0

An estimate of the item difficulty was obtained for each test item by determining the percentage of students in the item analysis groups who got the item right. Since the difficulty index refers to the percentage getting the item right, the smaller the percentage figure, the more difficult the item; the higher the percentage figure, the easier the item. The maximum difficulty value is 100 percent which occurs when everyone responds correctly to an item. The minimum difficulty level is 0 percent. Gronlund suggests that test constructors ". . . should favor items at the 50 percent level of difficulty and those with the highest discriminating power".[175]

Item Discrimination

The discrimination index measures how well a test item identifies differences in the achievement levels of students. An estimate of an item's discriminating power can be found by comparing the number of students in the upper and lower groups who got the item right. The discrimination index is a correlation coefficient and thus ranges from -1.00 to +1.00. Positively discriminating items are desirable. Maximum positive discrimination of +1.00 is obtained only when all students in the upper group select the correct answer and no one in the lower group does. If an equal number of students in the upper and lower groups score equally well on an item, it has a discrimination index of 0 and is useless for measuring individual differences.

Hopkins suggests some general guidelines for determining whether the discrimination index (D) of an item is acceptable:

> The higher the D value for an item, the better that item discriminated. Any item which has a D value of +.40 or above is considered to be very effective in discriminating student differences. D values between +.20 and +.39 are

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[175] N. E. Gronlund, Constructing Achievement Tests (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1968), p. 88.

> usually considered to be satisfactory, but items with lower values in this range should be reviewed and revised to make them more effective discriminators.[176]

Items which discriminate negatively must receive special attention and rewriting or elimination is in order for items which have values below 0.00.

In examining Table 4, the reader should note that the test contains no negatively discriminating items. Sixty-one of the items have a positive discrimination index of .20 or greater. Table 4 shows a frequency distribution of item discrimination indices based on the seventy test items.

Table 4

Distribution of Discrimination Indices on Form I Test Items

Discrimination Indices	Number of Items at Each Level
.90 - .99	0
.80 - .89	1
.70 - .79	3
.60 - .69	12
.50 - .59	15
.40 - .49	5
.30 - .39	18
.20 - .29	7
.10 - .19	4
.00 - .09	5
Negative Discrimination	

[176]C. Hopkins and R. Antes, Classroom Testing Construction (Itasco, Illinois: F. E. Peacock Publishers, Inc., 1979), p. 156.

Distractor Effectiveness

In order to determine the effectiveness of each of the test item distractors, it was necessary to compare the number of students in the upper and lower groups who selected each incorrect alternative. A good distractor will attract more students from the lower group than the upper group. Alternatives attracting more students from the upper group and alternatives attracting no one would have to be revised or replaced. Consequently, revisions of a somewhat minor nature were carried out on fourteen test items. The revisions involved rewriting or changing of test item alternatives due to their acting as: (1) weak alternatives attracting only a single response from those students in the item analysis groups, or (2) ineffective alternatives attracting no response from students in the item analysis groups.

The items upon which alternative revisions were made are items numbered 9, 12, 16, 17, 21, 27, 28, 54, 56, 57, 63, 65, 67, and 70. Appendix I presents the data pertaining to the effectiveness of these items' alternatives.

In effect the modification of test item stems and distractors meant using untried material which might have been less valid than that which it replaced.

Item Selection

From the items administered initially, it was hoped to obtain sufficient items to construct a test capable of assessing student achievement in all six of the map reading skill areas discussed previously. This researcher established selection criteria to serve as a general guide for test item selection. The researcher's judgement was employed in deviating from these criteria. Criteria for selection of items for this final form of the test were based on the following: (a) A reasonable number of test items were required to assess each skill area. (b) Difficulty levels of items between 25 percent and 75 percent were sought; those chosen outside these levels were significantly modified with the aim of improvement. (c) Positive discrimination indices of .20 and greater were desired; any item chosen below this level was changed in an attempt to increase its effectiveness.

On the basis of the selection criteria outlined, this researcher decided to retain sixty of the original test items for inclusion in the final form of the test, Form II (see Appendix E). Ten of the original items were either too easy, too difficult, or otherwise unsatisfactory for the purpose of the test. The ten items that were eliminated are numbers 3, 8, 10, 11, 14, 15, 18, 43, 53, and 59. Of the sixty items chosen for inclusion on the test, fifty-five fell within the criteria as outlined for item selection. Five items were chosen which did not fall within the guidelines, but they were viewed by this researcher as essential elements of the test.

Many factors may be viewed as contribuing to the quality of a test. Among such factors are appropriate difficulty and discrimination indices for test items, as well as effective item distractors. Another important factor is test balance. As Hopkins suggests:

> When appraising whether or not a test has been successful in doing what it is supposed to do, the individual should ask two questions about the items which make up the test.
> 1. Are the items selected for the test representative of the achievement which is to be assessed?
> 2. Are there enough items on the test to adequately sample the content which has been covered and the behaviors as spelled out by the objectives?[177]

Though their original test item analysis data did not conform to the established criteria, test item numbers 19, 20, 29, 42, and 55 were retained and revised with the aim of improving their item analysis data on a subsequent administration of the test. Items 19 and 20 were retained as the sole items assessing objectives 4a and 4b. Items 29 and 55 were retained and revised as second items assessing objectives 3a and 5a. Item 42 displaying fair

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[177] C. Hopkins and R. Antes, Classroom Testing Construction (Itasco, Illinois: F. E. Peacock Publishers, Inc., 1979), p. 160.

discrimination of .23 was retained and revised to assess objective 5b. This researcher deemed these items to be desirable elements of the map reading test when considering the objectives to be assessed by the test.

The nature of the modifications to specific test items and to the test as a whole may be examined by referring to Appendix D, Form I, of the seventy item test and Appendix E, the revised sixty item test, Form II.

The elimination of ten test items from the seventy item test and the availability of difficulty indices for test items also resulted in a decision to alter the order of questions as presented on the original Form I of the test. This reordering was completed with a two-fold purpose: firstly, to balance the test into two parts that could be administered in two forty-minute periods; secondly, to allow for questions with lower difficulty values to be placed at the beginning of each part of the test so as to encourage testee confidence and motivation. Appendix G shows the correspondence between test items on Form I, the seventy item test, and the revised, Form II, sixty item test.

The correspondence between test items and skill objectives also needed to be redefined as a result of the revisions in the test. Appendices K and L present the changes.

The teacher's manual was also revised as a result of the initial tryout of the test. A new introductory section was added to the manual. Changes were also specified in time allotments for the testing sessions (see Appendix F and Appendix G).

Test Reliability

"A test is reliable to the degree it measures whatever it measures consistently".[178] Measurements are reliable, then, if they reflect "true" rather than chance aspects of the skill or ability being tested. To the extent that chance conditions have been reduced, reliability will be high and the measurements taken will provide dependable data. Reliability thus describes the extent to which measurements can be depended on to provide consistently unambiguous information.

The reliability of the seventy item test was calculated using the Kuder-Richardson 20 formula and procedures as outlined by Gilbert Sax.[179] The reliability of the test was estimated to be .91. Thus, the map reading test may be considered to be highly reliable.

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178 C. Hopkins and R. Antes, Classroom Testing Construction (Itasco, Illinois: F. E. Peacock Publishers, Inc., 1979), p. 40.

179 G. Sax, Principles of Educational Measurement and Evaluation (Belmont, California: Wadsworth Publishing Co., Inc., 1974), pp. 264-267.

The Kuder-Richardson 20 reliability is determined from a single administration of the test. Unlike the split-half method, the researcher does not have to decide in which way a test should be split and then have to score each half of the test separately. Instead, the Kuder-Richardson 20 method provides an estimate of the average reliability found by taking all possible splits without actually having to do so. The Kuder-Richardson 20 formula was particularly appropriate because it utilized the item difficulty indices of each item which were made available as a result of the item analysis.

One of the conditions affecting the reliability of a test is the number of items on the test. Generally, items may be added to a test in order to increase a low reliability coefficient. However, this occurs only if the items added are similar to those already on the test.

This researcher reduced the length of the map reading test by ten items. The reduction in test items may have been expected to reduce the reliability of the test.[180] However, a test's reliability is also affected by the difficulty level of the test items. As outlined previously several of the test items were modified with the

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[180] G. Sax, Principles of Educational Measurement and Evaluation (Belmont, California: Wadsworth Publishing Co., Inc., 1974), p. 270.

aim of moving their difficulty levels towards the 50 percent level of difficulty. It was hoped those revisions might have compensated for any loss of test reliability due to the shortening of the test.

Test Validity

Since test scores may serve more than one use, there is more than one type of validity. Content, criterion-related, and construct are just a few of the terms used in educational literature concerning validity of tests. What is meant by validity?

"A test is said to be valid when it measures what it is intended to measure".[181] Which type of validity mentioned above is most appropriate to consider as applied to the map reading skills test?

> A kind of validity classroom tests of achievement in learning are supposed to have is content validity: that is, they are supposed to sample representatively and adequately the content of the course of instruction.[182]

> To establish test content validity, then:

> We must match the analysis of test content against the analysis of course content and

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[181]F. Gorow, Better Classroom Testing (San Francisco: Chandler Publishing Company, 1966), p. 12.

[182]R. Ebel, Essentials of Educational Measurement (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1979), p. 303.

> instructional objectives and see how well the former represents the latter.[183]

In order to arrive at a high level of content validity, Thorndike has suggested some sources to which the test developer can resort to guide him in test construction. The sources as identified by Thorndike are:

> (1) the more widely used textbooks in the field [the textbooks in use in Newfoundland schools in social studies programs from grades four to eight];
> (2) recent courses of study [Design for Social Studies, K-VI in Newfoundland and Labrador];[184]
> (3) reports of special study groups, often appearing in yearbooks at one or another of the educational societies [Maps and Globe Skills, K-7];[185]
> (4) groups of teachers giving instruction in the course;
> (5) specialists in university, city, and state departments.[186]

The brackets after the items above contain examples of how this test developer proposed to meet the requirements

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[183] R. L. Thorndike and E. Hagen, Measurement and Evaluation in Psychology and Education (3rd ed.; New York: John Wiley and Sons, Inc., 1969), p. 58.

[184] Division of Curriculum, Design for Social Studies, K-VI in Newfoundland and Labrador (St. John's, Nfld.: Department of Education, n.d.).

[185] Division of Curriculum, Map and Globe Skills, K-7 (St. John's, Nfld.: Department of Education, n.d.).

[186] R. L. Thorndike and E. Hagen, op. cit., p. 165.

of content validity. Consideration was, of course, also given to the review of research and related literature as well as to the theoretical positions outlined in chapter one.

Story in discussing the various types of validity outlines briefly the processes involved in demonstrating each type of validity. Content validity is established when:

> . . . an expert examines the content or curriculum to be measured, examines test items and judges the degree to which they correspond.[187]

In order to establish validity the seventy item test was submitted to five individuals. Two of these were teachers of grade eight geography having had at least three years of experience teaching the geography program at the grade eight level. Two instructors from Memorial University of Newfoundland examined the initial form of the test as well. One of these was in the social studies division of the Faculty of Education and the other was an instructor in cartography in the geography department, Faculty of Arts. The test was also examined by a testing expert with the American Guidance Service at Circle Pines, Minnesota. Among the more significant suggestions proposed by these experts

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[187]A. Story, The Measurement of Classroom Learning (Chicago: Science Research Associates, Inc., 1970), p. 31.

and acted upon by this researcher were the following:

(1) The test was divided into two parts for administration during two testing sessions as opposed to a single testing session as was originally planned.

(2) Changes were made in the wording of the statements of objectives to increase clarity.

(3) The original maps drawn by this researcher were criticized for lacking clarity. These maps had been hand drawn on stencils and duplicated using a Gestetner duplicator. This method was abandoned. The maps for inclusion in the test were subsequently redrafted by a cartography student. Improvements resulted in the total appearance of the maps as well as in such specific areas as:

(a) A better distinction was drawn between land and water areas.

(b) Different value shading was used to symbolize the data presented on some maps.

(c) There was an increase in the clarity of the names on the maps.

(d) Different sizes of lettering were used for different types of data.

(e) The clarity of the map on page two of the map booklet was improved significantly by redrafting it at twice the scale it was originally drawn (see Appendix C, Form Ia, of the map booklet and Appendix D, Form Ib, of the map booklet.)

SUMMARY

This chapter has outlined in some detail how the map reading test developed for the purposes of this study has been constructed by following the test development procedures as outlined by experts in the field. Discussion has focused on the close relationship between the test items and objectives and the map reading skills seen as being part of the social studies curriculum in the Province of Newfoundland and Labrador. The initial tryout and subsequent revision of the original Form I of the test has been outlined. The chapter has thus focused on the evolution of Form II of the map reading test which was used to gather data for normative purposes.

CHAPTER FOUR

RESEARCH METHODOLOGY

Preview

The previous chapter dealt with the procedures followed in the development of a map reading test designed to measure the attainment of selected map reading skills of beginning grade nine students. In this chapter will be presented the descriptive hypothesis and limitations of this study. The sample selection procedures will be outlined and the sample used in this study to gain normative data will be described. The actual performance of beginning grade nine students in each of the map reading skills will be discussed.

RESTATEMENT OF THE PROBLEM

The purpose of this study was to develop and standardize an assessment instrument useful for measuring selected map reading skills in Newfoundland students who are at the onset of grade nine. In more specific terms, the research study sought to answer this question:

1. To what degree have students in grade nine attained the following map reading skills?
   (a) understanding directions
   (b) understanding elevation
   (c) understanding location
   (d) understanding grid systems

(e) use of scale

(f) interpreting information from maps

DESCRIPTIVE HYPOTHESIS

In order to assess the attainment of grade nine students, the following descriptive hypothesis was proposed.

Students will achieve, according to their performance expressed as a percentage score on the test of map reading, the degree to which they have acquired the map reading skills dealing with:

(a) directions

(b) elevation

(c) location

(d) grid systems

(e) scale

(f) map interpretation

LIMITATIONS OF THE STUDY

1. This study was limited to the extent that the sample of students chosen was representative of the population of grade nine students.

2. The map reading skills which were assessed in this study pertain for the most part to those mentioned in the curriculum guides and texts used throughout the grades four to eight geography program. The degree of formal classroom instruction in each of these skills to which students may

have been subjected in grade four to the beginning of grade nine may vary. It is assumed though that the same textbooks will have been used in all cases.

3. The test was limited to an assessment of selected map reading skills chosen for this study and therefore did not tap or assess other skills which may have been as important.

4. Any conclusions drawn about the map reading skills of individuals or groups of grade nine students are limited to the extent that the test items are an inadequate and representative sample of map reading skills.

5. The study was limited in that it was assumed that test results were a result of standardized administration procedures which presumably have been followed as outlined in the test manual.

6. The map reading test, based on skills presumed to have been taught up to the end of grade eight, was administered to students during the month of October in 1983. Therefore, the study was limited to the extent that some of the skills tested may have been mastered by students during the first several weeks of grade nine.

POPULATION

The population for the purpose of this study will be all students in grade nine in the Province of Newfoundland and Labrador who are enrolled in geography classes during the 1983-84 school year.

SAMPLE

It is often difficult to set up research studies in a manner which meets satisfactorily all the conditions of a controlled scientific study. There are many instances in empirical research where compromises must be made in terms of random selection of students who are to participate in a study. As Roscoe states:

> In practical research, the size of the sample is largely determined by economic considerations and the availability of subjects.[188]

For the purpose of this study, a sample of ten grade nine geography classes was selected from the population. These classes containing grade nine students were selected by following the cluster sampling procedure outlined below.[189]

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[188] J. Roscoe, Fundamental Research Statistics for the Behavioral Sciences (New York: Holt, Rinehart and Winston, 1969), p. 176.

[189] M. C. Johnson, A Review of Research Methods in Education (Chicago: Rand McNally College Publishing Co., 1977), pp. 149-150.

(1) First, a list of all schools in the province that contained grade nine students was formulated. The names of two hundred thirty-one schools were on this list.

(2) Each school was assigned a number starting with 1 and continuing in sequence to the nth school.

(3) By using a table of random numbers, a sample of ten schools was then chosen.

(4) If a school chosen in (3) had a single class of grade nine students studying geography, then that class was the one chosen to participate in the study.

(5) If a chosen school had two or more classes taking grade nine geography, then one of the classes in the school was randomly selected to participate in the study.[190] The selection was made either by this researcher or the school principal.

It is from this sample that the norms for the test were established.

In following the above procedure, ten grade nine geography classes were selected ranging across nine different school boards. There was a total of thirty-five school boards across the province. All ten classes in the schools contacted actually participated in the study. This sample was comprised of students drawn from 4.3 percent of the schools in the province. The sample was distributed across

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[190] V. Ellingstad and N. Heimstra, Methods in the Study of Human Behavior (Monterey, California: Wadsworth Publishing Company, Inc., 1974), pp. 46-53.

25.7 percent of the school boards in the Province of Newfoundland and Labrador. In order to preserve the anonymity of the students, teachers, schools, and principals involved in this study, it was decided by this researcher to reveal only the names of the school boards in which participating classes were selected. Table 5 outlines the characteristics of the sample chosen from each board.

Table 5

Characteristics of the Study Sample

Map No.	Board	Sample Size	Sex M	Sex F	Age in Years 13	14	15	16	17
	(Integrated)								
101	Vinland	14	4	10	2	6	4	1	1
103	Deer Lake	28	8	20	4	24			
107	Terra Nova	29	19	10	3	17	5	4	
111	Avalon Consolidated	*48	21	26	11	24	8	2	3
115	Bay of Islands-St. Georges	20	12	8	1	15	4		
126	Burgeo	25	13	12	4	20		1	
	(R.C.)								
506	Exploits-White Bay	16	11	5	1	12	3		
511	Placentia-St. Mary's	25	13	12	1	14	4	4	2
514	St. John's	15	15	0	1	12		2	
	Total	*220	116	103	28	144	28	14	6

*The discrepancies in the totals are due to the inability to determine the sex of one of the students in the sample.

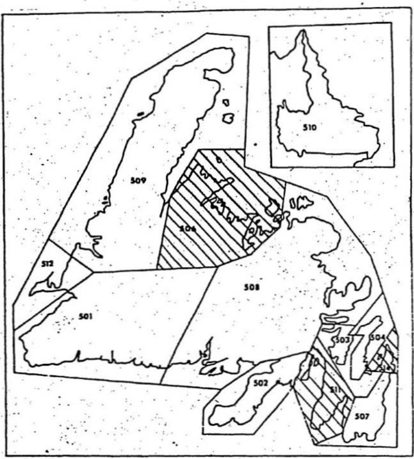

Figure 1

Roman Catholic School Districts

Source: Division of School Services, Directory of Newfoundland and Labrador Schools, (St. John's, Nfld.: Department of Education, 1982), p. 44.

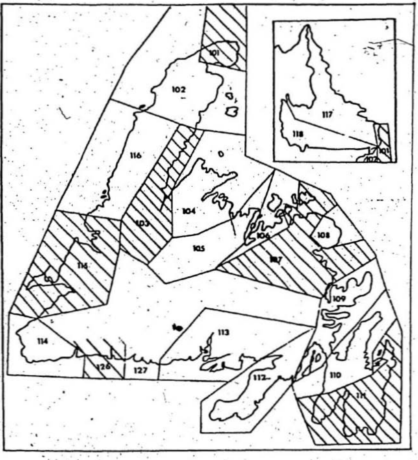

Figure 2

Integrated School Districts

Source: Division of School Services, Directory of Newfoundland and Labrador Schools, (St. John's, Nfld.: Department of Education, 1982), p. xvii.

There was one grade nine class selected in each of the school boards listed with the exception of the Avalon Consolidated School Board in which one class in each of two different schools participated. An examination of Figures 1 and 2 gives an indication of the various geographic regions of the province from which the sample was drawn. The shaded districts were the ones to have had students participate in the study.

The correspondence conducted between this researcher and the various school boards may be examined by referring to Appendix M. These items of communication are arranged in chronological order. The researcher's schedule for the tryout of the initial test items and his subsequent test revision were also altered as a result of a labor dispute. This dispute between the Newfoundland Teachers' Association and the Government of Newfoundland and Labrador resulted in the closure of almost all of the schools in that province for a three week period beginning in April and ending in May of 1983.

TEST ADMINISTRATION

During the second week of September, 1983, test packages were sent to the grade nine classes selected as the sample for this study. Each package included a letter to the teacher of the participating class, appropriate copies of the map reading question booklet and map booklet, a teacher's manual for test administration, and instructions for the return of the tests to this researcher. A total of ten grade nine geography classes from nine different school boards participated in the study. Two hundred twenty students completed the map reading tests. This represented approximately 2 percent of the total grade nine enrollment in 1983-84 of approximately eleven thousand.

The testing was expected to have been completed between the third and the fourteenth of October. However, only nine classes reported having completed the testing within these dates. The tenth class completed the tests during the period of October nineteenth to the twenty-first. The prompt return of tests to this researcher was carried out by eight participating classroom teachers. Delays were experienced in receiving the tests from the other two participating classes.

DATA AND STATISTICAL ANALYSIS

Since this thesis was concerned mainly with the development and standardization of a map reading test, the focus on the statistical analysis will deal with descriptive statistics which may be used to describe the performance of the sample as a whole on the entire test and on subtests built within the instrument.

The individual students' tests were scored by this researcher and then the data for the total group were analyzed by using the Statistical Package for the Social Sciences[191] computer program. On the basis of the data analysis, it was possible for this researcher to revise the teacher's manual with the aim of making it more complete and comprehensive for future use. The revised manual in Appendix H contains a condensed version of much of the information in this chapter. The inclusion of the additional material is meant to aid teachers in the interpretation of student scores and diagnoses of student performance.

A Kuder-Richardson 20 reliability coefficient of .89 was produced on the overall test. Thus, the test as a whole may be viewed as being a fairly reliable instrument. Subsequent analysis of the subtests indicated that lower reliability indices were produced. Table 6 presents the Kuder-Richardson 20 reliability coefficients for the whole test and for each subtest. The lower indices for the subtests may be attributed to the small number of items in each of these skill areas. The low reliabilities of the subtests may be viewed as a limitation of the test.

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[191]N. H. Nie, Statistical Package for the Social Sciences (2nd ed.; New York: McGraw-Hill, Inc., 1975).

The scores for the total test group are presented in Table 7. These raw scores are also accompanied by a frequency count. These data may be more graphically viewed in Appendix N, which shows a frequency polygon.

Table 6

Reliability Coefficients

Skill	Reliability Coefficient
Whole test	.89
Direction	.77
Elevation	.61
Location	.66
Grid Systems	.58
Scale	.55
Interpretation	.74

Table 7

Raw Scores and Frequencies

Score	Frequency	Score	Frequency	Score	Frequency
15	1	31	6	46	12
16	1	32	5	47	11
18	1	33	4	48	10
19	1	34	4	49	4
20	1	35	8	50	6
21	2	36	11	51	7
22	1	37	6	52	4
23	3	38	8	53	5
24	9	39	6	54	3
25	1	40	4	55	6
26	3	41	6	56	3
27	5	42	6	57	1
28	6	43	8	59	3
29	4	44	8		
30	7	45	9		

The students scored from a low of 15 to a high of 59 for a range of 44. The most frequently occurring score, called the mode, was 46. The middle score or median was 40.833, rounded to 41. The average score for the entire group of two hundred twenty students was a mean of 39.759, rounded to 40.

The findings related to the descriptive hypothesis concerning the performance of students in map reading skills are presented in the form of mean percentage scores. The findings are outlined as follows:

(a) Students scored correctly 67.39 percent of the items in the skill area of directions.

(b) Students scored correctly 66.76 percent of the items in the skill area of elevation.

(c) Students scored correctly 72.41 percent of the items in the skill area of location.

(d) Students scored correctly 62.12 percent of the items in the skill area of grid system.

(e) Students scored correctly 56.14 percent of the items in the skill area of scale.

(f) Students scored correctly 68.52 percent of the items in the skill area of map interpretation.

A summary of the raw and mean percentage scores, standard deviations, and standard errors is presented in Table 8. Not only does the table present the data for the total sample's performance on each subskill, but it also provides information based on a breakdown of the sample into the upper 20 percent, middle 60 percent, and lower 20 percent of the scores. Thus, there are several reference points to which a group's performance on the map reading test might be compared to the sample's achievement levels.

Table 8

Summary of Students' Performance on the Sixty Item Test

Skill	Total Possible Raw Score	Mean Raw Score	Standard Deviation (Raw Score)	Mean Percentage Score	Standard Deviation Percentage Score	Standard Error Percentage Score
WHOLE TEST	20	39.8	9.9	66.3	16.5	1.1
Upper 20%	60	52.6	2.9	87.7	4.9	
Middle 60%	60	40.3	5.3	67.2	8.9	
Lower 20%	60	25.2	3.8	42.0	6.3	
DIRECTIONS	8	5.4	2.2	67.4	27.6	1.86
Upper 20%	8	7.7	0.8	95.7	10.1	
Middle 60%	8	5.4	2.0	67.3	24.7	
Lower 20%	8	3.1	1.4	39.2	17.2	
SCALE	6	3.4	1.6	56.1	27.7	1.80
Upper 20%	6	4.8	1.1	79.2	18.4	
Middle 60%	6	3.2	1.5	53.9	25.5	
Lower 20%	6	2.4	1.3	39.8	22.2	

Table 8 (Cont'd.)

Skill	Total Possible Raw Score	Mean Raw Score	Standard Deviation (Raw Score)	Mean Percentage Score	Standard Deviation Percentage Score	Standard Error Percentage Score
ELEVATION	8	5.3	1.9	66.8	23.2	1.56
Upper 20%	8	6.9	1.0	86.1	13.0	
Middle 60%	8	5.6	1.5	69.1	19.1	
Lower 20%	8	3.2	1.5	40.3	18.5	
GRID SYSTEM	12	7.5	2.2	62.1	18.5	1.25
Upper 20%	12	9.7	1.8	81.1	15.2	
Middle 60%	12	7.4	1.8	61.4	14.7	
Lower 20%	12	5.4	1.7	45.3	14.1	
LOCATION	10	7.2	2.2	72.4	21.9	1.48
Upper 20%	10	9.4	0.8	93.6	7.5	
Middle 60%	10	7.4	1.6	74.5	16.4	
Lower 20%	10	4.5	1.8	45.0	18.0	
INTERPRETATION	16	11.0	3.2	68.5	20.3	1.37
Upper 20%	16	14.3	1.3	89.1	8.1	
Middle 60%	16	11.3	2.1	70.9	13.4	
Lower 20%	16	6.5	2.5	40.8	15.8	

On many tests scores are interpreted by comparing an individual's performance with that of others in the norm group. The norm group provides a basis for comparison by showing the scores of a standard reference group.

The results of the administration of the map reading test to two hundred twenty students provide baseline data in relation to this sample's performance on the test. In order to facilitate comparison with another group's performance, this sample may be considered as a norm group. Consequently, tentative norms were developed based on the results obtained by this sample. The raw scores on the map reading tests were converted to a type of standard score, T scores. Percentile ranks were also derived from the raw scores.

One of the most widely used methods of expressing test raw scores is by using percentile ranks. "The percentile rank for a score is defined as the percentage of persons in the norm group who obtain lower scores".[192] Thus, for example, if a student scored at the 29th percentile on the map reading test, he scored better than 29 percent of the students in the norming group and 71 percent scored as high or higher. In this test, the percentile rank indicates the pupil's relative rank in a group of 100 pupils who are

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[192] F. G. Brown, Principles of Educational and Psychological Testing (New York: Holt, Rinehart and Winston, 1976), pp. 180-181.

similar with respect to grade placement. Table 9 presents the percentile ranks derived from the students' raw scores on the map reading test.

Table 9

Raw Scores, Percentile Ranks, and T Scores

Raw Score	Percentile Rank	T Score
15	0.2	21.2
16	0.7	25.4
18	1.0	26.7
19	1.6	28.6
20	2.0	29.5
21	2.7	30.7
22	3.0	31.2
23	4.0	32.5
24	7.0	35.2
25	9.0	36.6
26	10.0	37.2
27	12.0	38.3
28	15.0	39.6
29	17.0	40.5
30	19.0	41.2
31	22.0	42.3
32	25.0	43.3
33	27.0	43.9
34	29.0	44.5
35	31.0	45.2
36	36.0	46.8
37	40.0	47.5
38	43.0	48.2
39	46.0	49.0
40	48.0	49.5
41	51.0	50.3
42	53.0	50.8
43	56.0	51.5
44	60.0	52.5
45	64.0	53.6
46	69.0	55.0
47	74.0	56.4
48	79.0	58.1
49	82.0	59.2
50	84.0	59.9
51	89.0	62.3
52	90.0	62.8
53	92.0	64.0
54	93.0	64.8
55	96.0	67.5
56	97.0	68.8
57	98.0	70.5
59	99.0	73.3

Table 9 presents T scores derived from the raw scores. The T score system is a normalized standard score system wherein the T scores are area transformed standard scores. The major advantage of this system is that it allows for direct comparisons of scores on two or more tests. Even though a student may obtain different raw scores on two tests, the conversion of the raw scores to T scores may result in a student's falling in the same relative position on both tests. T scores are computed by determining the percent of students scoring below each raw score; these percentages are next converted to normal deviates (z scores) by referring to tables of the normal curve.[193] The obtained z scores are then used to calculate T scores by using the formula $T = 50 + 10(z)$.[194]

Appendix O contains an abbreviated list of skill statements in the map reading test and a list of items relating to each particular skill. Also provided in Appendix O is the percentage of students in the sample who got each item correct. By using this information, it is possible to compare the performance of students in the norm group with students at a board, school, or classroom level. Diagnosis of areas of skill strengths

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[193] H. Gulliksen, Theory of Mental Tests (New York: John Wiley and Sons, Inc., 1950), pp. 280-282.

[194] F. G. Brown, Principles of Educational and Psychological Testing (New York: Holt, Rinehart and Winston, 1976), p. 185.

and weaknesses may be identified for groups of students. By examining Appendix O, it is possible to note several points about the performance of the study sample in specific skills.

In considering the following observations relative to Appendix O, the reader must give consideration to two points: first, single items have many specific idiosyncratic factors that affect their difficulty and this may be borne in mind by the reader when reading about comparisons among single items measuring different skills; second, sampling error had to be accounted for by using a confidence interval within which to view differences between item difficulty values. The actual difficulty values obtained by the sample are those used in the discussion of student performance in the following section. Reference to Appendix O will also provide the reader with the 95 percent confidence interval around each obtained score. The limits of the confidence interval are obtained by taking the obtained score and adding and then subtracting 1.96 times the standard error of measurement.[195] There is a 95 percent chance that the true score of a group of students falls within the limits of the confidence interval established around the obtained score. The standard errors of measurement of the percentage scores in each of the subskills are recorded in Table 8.

[195] F. G. Brown, Principles of Educational and Psychological Testing (New York: Holt, Rinehart and Winston, 1976), pp. 80–82.

Directions

Students exhibited almost complete comprehension of the fact that in most instances north is located towards the top of the map. Items involving the student's understanding of intermediate directions received fewer correct responses (59 percent) than those involving cardinal directions (69 percent).

Scale

Students experienced the highest number of correct responses in answering questions that required them to measure the linear distance between two points (71 percent). About 50 percent of the items were answered correctly that dealt with computing distances over a defined path (47 percent) and comparing distances on maps of different scales (51 percent). It is interesting to note as well that of the six skills tested on the map reading test the students' overall performance was lowest on those dealing with scale (56 percent).

Elevation

The map reading test developed used various degrees of shadowing to indicate different levels of elevation. The identification of elevation levels of various places was indicated by students correctly answering 79 percent of the items dealing with skill objectives 3a and 3b. Fewer responses were encountered in students' attempts to relate the course of a river to elevation levels (64 percent). Students experienced the greatest number of errors in attempting to relate a cross sectional profile of an area to a map of the area (47 percent). One of the items testing this skill, item 17, was correctly answered by 32 percent of the students, making it the third lowest percentage correct score of all items on the whole test.

Grid Systems

Two basic types of grid systems were used on the maps in the test: the alphabetical-numerical system and lines of latitude and longitude marked in degrees. Comprehension of the alphabetical-numerical system was evidenced by students scoring in excess of 90 percent of those test items correctly. On the items involving the use of lines of latitude and longitude, students would correctly locate a place 79 percent of the time when the coordinates of a place were provided. In identifying the coordinates of a given place, 60 percent of the items were scored correctly. About 60 percent of the items were scored correctly that tested the students' understanding of the fact that all points along meridian lines share the same longitude. Students apparently experienced confusion in associating lines of latitude with the directions east and west and lines of longitude with the directions north and south. Most of the difficulty was presented by items numbered 20 and 44 dealing with the ability of the students to identify the correct longitude of a given place.

Twenty percent of the students answered item 20 correctly, and 30 percent selected ~~the right answer for~~ item 44. ~~Thus,~~ these two items received the lowest number of correct responses of all the entire test.

Location

Of the six skill areas included on the map reading test, the highest percentage of items scored correctly dealt with location. Seventy-two percent of these items were correctly answered by grade nine geography students. Students experienced greatest success (79 percent) in using semi-pictorial symbols, such as rivers and lakes, to locate places. They scored a little lower (76 percent) on those items which required them to use a map legend. The use of unlabelled standard lines of latitude and longitude caused more incorrect responses from the students. Seventy-eight percent of the items were scored correctly that required the students to use the unlabelled Arctic Circle as an aid in location. Somewhat fewer items (69 percent) were answered correctly when students had to use the unlabelled equator as a locational device. The students' lowest performance occurred on an item requiring the use of an unlabelled standard line of longitude. Fifty-six percent of the items were correctly responded to when the students had to use the prime meridian as a reference line for locational purposes. The low performance of students on this item may be associated with the performance on items 20 and 30 which required the use of lines of longitude as part of a grid system. The use and understanding of longitude would apparently seem to be a particular area of student skill weakness.

Map Interpretation

The overall performance of students on those items testing the map interpretation objectives was the second highest of the six skill areas. Sixty-eight percent of the items were responded to correctly. This skill was tested by sixteen test items, the largest number assigned to any skill area. Consequently, there was quite a variation in student performance on specific items.

Students scored correctly, on average 73 percent of the time pertaining to skill 6a. These items required students to infer from the information on a map the nature of people's activities at a specific location.

Students performed at a lower level on item 6 requiring them to locate a described climatic area. Fifty-four percent success was scored on this item. This researcher notes at this point the desirability of assessing the performance of students on this particular objective because climatic information is often important for students to understand in regional studies.

The map reading test contained a total of twelve items assessing objectives 6c and 6d together. The range of correct scores on items assessing these objectives went from 48 percent correct to 86 percent. The item receiving the fewest correct responses was number 25. Upon subsequent analysis of this item, this researcher suggests that the low percentage of correct answers may be due to the students' lack of understanding of the term "artesian basins".

A significant point to be noted by this researcher, however, is that the difficulty of any question offered for student response in the area of map interpretation, or in any skill area for that matter, is dependent on the nature of the question, the nature of the information available on the maps, as well as the ability of the student to comprehend and use the data presented. Improvement in the interpretation on one or more maps may be viewed as a skill requiring development on a wide variety of maps on a repeated basis over the entire school life of the student.

SUMMARY

Chapter four outlines the investigative methodology used in this study. The chapter started with a restatement of the problem followed by a specification of the descriptive hypothesis for the study. Limitations of the study were also outlined.

The sample selection procedures were described. A two hundred twenty student sample was selected from ten schools across nine school boards in the Province of Newfoundland and Labrador.

The Statistical Package for the Social Sciences[196] was used to establish the Kuder-Richardson 20 reliability of the map reading test at the 0.89 level.

Numerous tables throughout the chapter presented the raw scores as well as their subsequent conversion to T scores and percentile ranks.

Mean percentage scores were tabulated for the test as a whole and for each of the six subtests. In the skill areas of directions, elevation, and map interpretation, students answered correctly between 67 and 69 percent of the items. Sixty-two percent of the test items dealing with grid systems were correctly answered. Students indicated greatest attainment, with 72 percent of the items correct, in the skill area of location. In contrast, the students' lowest attainment was in the skill area of scale in which 56 percent of the test items were scored correctly by students. The relevance of these results will be discussed in the next chapter.

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[196] N. H. Nie, Statistical Package for the Social Sciences (2nd ed.; New York: McGraw-Hill, Inc., 1975).

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

Introduction

The previous chapter outlined in detail the performance of the selected sample in the skills serving as the focus of the map reading test developed for this study. Chapter five will examine the findings revealed in the analysis of data in relation to similar findings reported in the work of other investigators. Generalizations that may be derived from this study are also presented. Finally, a number of recommendations and suggestions for further research and for curriculum and instruction are outlined.

FINDINGS

The results obtained in this study are based on the data collected through the administration of the norm referenced map reading test developed by this researcher. Any comparisons made with the findings of other researchers are only for the interest of the reader. The completion of this study was carried out with the intention of providing a standard or set of baseline data against which subsequent groups using this instrument might make comparisons.

It is not the purpose of this researcher to make absolute value judgements about the strengths and weaknesses of students and then compare this sample's performance to other groups. Consistencies with the findings of other researchers are outlined, however, but merely for the purposes of reader interest.

The development and standardization of the map reading test which was the focus of this study would support the views of Robertson,[197] Bettis and Manson,[198] and Pack[199] who believed that the measurement of map reading skills requires the use of valid and reliable testing instruments sensitive to the objectives of the social studies programs of a region.

Among the specific findings regarding the skills evaluated by the map reading test was that students scored the lowest percentage of correct scores in the skill items dealing with scale. The results of this study are

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[197] D. J. Robertson, "The Development and Standardization of an Objective Test of Elementary School Geography," (Master's thesis, McGill University, 1968).

[198] N. C. Bettis and G. A. Manson, "An Assessment of the Geographic Learnings of Fifth Grade Students in Michigan", Journal of Geography, 74 (January, 1975), pp. 16-24.

[199] R. Pack, "An Assessment of Selected Geographic Skills Attained by Grade Five Students in Newfoundland," (Master's thesis, Memorial University of Newfoundland, 1979).

consistent with the findings of Millar,[200] Bartz,[201] and Printzing[202] who found that many of the children in their studies had low levels of performance on those test items involving scale.

R. J. B. Carswell[203] has suggested that students may learn about and use grid systems in the intermediate grades--four to six. The results of this researcher's investigation support the findings of Bartz[204] who found that children were familiar with latitude and longitude. The students in the sample chosen for this study scored 62 percent of the test items correct.

The mean percentage score of 67 percent in the skill of directions is consistent with the findings of Millar,[205]

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[200] G. J. Millar, "Testing Map Reading Ability", Journal of Geography, 30 (January, 1931), pp. 38-42.

[201] B. Bartz, Map Design for Children (Chicago: Field Enterprises Educational Corporation, 1965).

[202] V. E. Printzing, "Aerial Photographs and Topographical Map Comprehension by Chicago Students of Eight Parochial Schools - Grades Four and Eight," (Doctoral dissertation, University of Northern Colorado, 1974).

[203] R. J. B. Carswell, "Topographic Map Reading Abilities of Learners in Grades Four, Five, and Six," (Doctoral dissertation, University of Florida, 1968).

[204] B. Bartz, loc. cit.

[205] G.J. Millar, loc. cit.

Preston,[206] and Douglass.[207] The lower percentage of correct scores in the area of intermediate directions is similar to the performance displayed by the children in Bartz's[208] sample.

In the understanding and use of locational skills, students achieved the highest mean percentage score of all the skill areas tested. The 72 percent level of success on these test items may be attributed largely to the student's ability to comprehend map symbols. The work of Howe[209] and Carswell[210] suggested that symbol comprehension was within the ability level of students in elementary grades when specific instruction was provided.

Carswell[211] contended that students in the elementary grades could learn about and use elevation on maps. The

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[206] R. C. Preston, "A Comparison of Knowledge of Directions in German and in American Children", Elementary School Journal, 57 (December, 1956), pp. 158-160.

[207] M. P. Douglass, "Laterality and Knowledge of Directions", Elementary School Journal, 66 (November, 1965), pp. 69-74.

[208] B. Bartz, Map Design for Children (Chicago: Field Enterprises Educational Corporation, 1965).

[209] G. F. Howe, "A Study of the Ability of Elementary School Pupils to Read Maps", in The Teaching of Geography, ed. G. M. Whipple, Thirty-second Yearbook of the National Society for the Study of Education (Bloomington, Illinois: Public School Publishing Co., 1933), pp. 486-492.

[210] R. J. B. Carswell, "Topographic Map Reading Abilities of Learners in Grades Four, Five, and Six," (Doctoral dissertation, University of Florida, 1968).

[211] Ibid.

results of this study indicate that students had a 69 percent success level on the test items on evaluation. The lack of textual material involving the use of contour lines and the omission of test items requiring the use and understanding of contours must also be given consideration when examining the level of performance of students in the sample.

The overall achievement of 69 percent in those test items involving map interpretation seem to correspond approximately to the general performance of students on the test as a whole. The interpretation of information in many cases may directly or indirectly involve the use and understanding on one or several other map reading skills simultaneously. Achievement in the skill of map interpretation is therefore closely tied to the students' performance in the other map reading skills.

CRITICAL ANALYSIS OF THE STUDY

A degree of caution should be exercised in interpreting the results of this study. A number of these areas for consideration are outlined below.

The test developed and used for this study should be further refined and tested. The sixty items included in the test attempt to assess six selected map reading skills. There may be other skills that educators may consider to be just as worthy of assessment. Indeed, additions to, deletions from, or revisions in the statements of skill objectives may be desirable. However, it must be remembered that the statements of objectives provided are not meant to be all-inclusive. Revisions in the test may make it more representative of the various map reading skill areas. For example, the test contained a single item assessing objective 6b which required students to locate a described climatic area. It may be desirable perhaps to have one or two more items constructed to assess this particular objective on a number of different maps. A larger sample of items assessing this objective would hopefully supply more valid and reliable data pertaining to student performance.

The statement of skill objectives was based on the content embodied in the geography textbooks currently used in grades four to eight in Newfoundland and Labrador, the social studies curriculum guides published by the provincial department of education, and a review of pertinent research and literature. It is assumed that the skill designations in those publications are, indeed, areas of prime emphasis for teachers and students in the social studies classrooms of that province. However, the map reading test, though a reflection of current social studies literature, may not be a reflection of social studies practices in the classroom.

The performance of individual students or classes may have been directly affected by the children's attitudes towards the tests. The attitudes of the children may have been influenced by a particular teacher's degree of interest for giving them. A more appropriate procedure might have been to have one individual administer all of the tests. More rigid control of standard administration procedures might have been expected. Although desirable, it was not practical in light of the time and financial resources available to this researcher to carry out such a procedure.

A final practical consideration involved having the students mark their answers in the question booklet, thus making the scoring of the test both awkward and time consuming.

Consideration was given to the idea of using a separate answer sheet, but this method was abandoned because it would have required students to manipulate three items: the map booklet, the question booklet, and an answer sheet. This researcher felt this format would have been too confusing for the students.

CONCLUSIONS

Based on the findings of this study, the following conclusions may be drawn regarding the development of a map reading test to assess selected map reading skills.

1. The results of this study indicate that it has been possible to develop and standardize a valid and reliable map reading test for assessing the attainment of beginning grade nine geography students in the Province of Newfoundland and Labrador.
2. The statement of skill objectives, when used in conjunction with the test results, permits the use of the map reading test as a diagnostic instrument for the identification of the strengths and weaknesses of groups of students in six map reading skill areas.
3. The provision of T scores and percentile ranks permits the comparison of the performance of individual students with a relatively representative provincial norm group comprised of a sample of grade nine geography students drawn from various regions of the Province of Newfoundland.
4. Grade nine geography students in Newfoundland have achieved 66 percent success in comprehending and using six selected map reading skills.

On the basis of the findings of this study, the review of research and literature, and the theoretical positions outlined, it may be concluded that a map reading test suitable for application to social studies students at the beginning of grade nine in Newfoundland has been developed.

It is this researcher's view that the use of such a curriculum and objectives based instrument has the potential to assist in the furthering of the aims of geographic education in that province.

RECOMMENDATIONS

Listed below are a number of recommendations for further research:

1. The focus of this present research was primarily developmental in nature. The instrument developed could be used in a replicative study using a larger and more representative sample of grade nine geography students from whom to obtain normative data.
2. The review of learning and development theory indicated that the map reading skills tested by the research instrument are within the ability levels of elementary school children. The review of related research and literature pointed out that such skills are within the comprehension of elementary students, if appropriate learning opportunities are systematically provided. It is recommended, therefore, that the map reading test be administered to students in the elementary and junior high school grades (four to eight). Several purposes could be served by this research:

(a) to measure student attainment at various grade levels, (b) to compare student performance on a grade-by-grade basis, (c) to measure significant growth in the map reading skills of students, and (d) to enable identification of skill areas requiring remediation.

3. It is suggested that if the map reading test is used in elementary school grades that an appropriate "readability formula" be applied to the test so as to prevent students' scores from being unduly affected by their lack of comprehension of vocabulary used in the test. Appropriate revisions in test items may then have to be made.

4. The issue of validity is central to the usefulness of any test. The writer suggests that a questionnaire be developed based on the statement of skill objectives this test purports to assess. The purpose of the questionnaire would be to have the respondents (e.g., a sample of grade eight geography teachers) indicate whether or not the skill objectives were considered during the course of a year's work. Information could be obtained on the nature of classroom experiences students had encountered in relationship to specific skill objectives. Through such a procedure at various

grade levels, a researcher could obtain an indication of the degree of direct correspondence between test skill objectives and the actual classroom practices as reported by teachers.

5. A study could be carried out to investigate the strategies teachers employ to teach the sequence of map reading skills proposed in the curriculum guides referred to earlier in this report as published by the Department of Education for the Province of Newfoundland and Labrador.
6. Recognizing that a pupil's behavior is influenced by his attitudes and the attitudes of his teachers, two studies are suggested: first, a study of teachers' feelings about the teaching of map reading skills at the primary, elementary, and junior high school levels; second, a study of students' attitudes at the same school levels towards map reading and map making.
7. The relationship between the geographic education of teachers and their attitudes and those of their pupils toward cartography might be worth investigating.

Having made several recommendations that focus on the conducting of further investigations, this observer will now outline several suggestions arising out of this study that do not directly involve research.

1. There is a need for in-service education for primary, elementary, and junior high school teachers in the area of geographic education. More specifically, the nature of the in-service training to be provided should help teachers to: (a) become increasingly aware of the sequence of map and globe skills as outlined in Map and Globe Skills: K-7,[212] (b) provide a systematic approach to the development of map and globe skills on a continuous basis, (c) realize fully that students learn best by "doing" and therefore the use of maps and globes in the classroom should mean student use, not merely teacher use, (d) understand the capabilities of their students in regard to learning and developmental theory as it relates to map reading skill development.
2. Teachers, administrators, and program coordinators need to undertake an aggressive program to discover and subsequently borrow or purchase materials needed to supplement the textbooks currently used. Tapes, slides, filmstrips, films, models, maps, charts, and atlases are examples of the types of media available to aid in the development of map reading skills. The

[212]Division of Curriculum, Map and Globe Skills: K-7 (St. John's, Nfld.: Department of Education, n.d.).

acquisition of common classroom atlases may also facilitate small and large group activities.

3. Classroom teachers and district testing specialists should be encouraged to use testing devices, such as the instrument developed in this study, to ascertain the level of map reading skills possessed by students. The development of school or district norms relevant to the local situation could then be established.

4. The development of an ongoing program of evaluation in geographic education in general and map reading skills in particular should be initiated in schools and districts that have not already done so. This writer contends that the administration of map reading tests to students by teachers heightens their awareness of this aspect of geographic education and may result in an increased demand to study maps in more detail and to use them more frequently.

SUMMARY

This chapter has discussed in some detail the findings of this study. The primary conclusion arising out of the results of this research was that the map reading test developed for this study may be considered to be a valid and reliable testing instrument for assessing the skills of beginning grade nine geography students in the Province of Newfoundland and Labrador. Among the recommendations for further research is the desirability of a cross-grade comparison of map reading skills as assessed by the map reading test developed for this study. The final section of the chapter dealt with suggestions pertaining to curriculum and instruction. The point was emphasized that a heightened awareness for the development of map reading skills is needed throughout the whole social studies curriculum from kindergarten to grade nine.

CHAPTER SIX

SUMMARY OF THESIS

The purpose of this study was to develop and standardize a map reading test that could be used to assess the attainment of students at the beginning of grade nine in the Province of Newfoundland and Labrador.

One of the chief skills that may be acquired by social studies students is the ability to read maps. The development of map reading skills is a slow, sequential, and cumulative process according to learning experts and psychologists. They contend that the child's capacity for learning increases with age from early childhood to the teenage years. The success a student attains in any prescribed task is dependent, however, on the previously learned concepts and skills. To be effective, then a learning program must take into account what a child already knows. Evaluation is the means for gathering such data about individuals.

This writer took the position that tests developed for other regions of Canada or the Canadian population at the grade nine level were not suitable for use by students in this province because of the lack of correlation between the skill objectives assessed by these tests and the skill objectives as outlined in the curriculum of the Province of

Newfoundland and Labrador. This writer's energies were thus funnelled towards the creation of an instrument relevant to the stated skill objectives of the curriculum guides and textbooks currently used in that province.

A review of the research and related literature revealed a recognition of the essential role played by map reading skills in the social studies curriculum and of the great need for their development.

Studies reviewed indicated a general lack of proficiency in map reading skills in elementary and junior high school students. This was surprising in light of research indicating that when students were given a program of systematic instruction in selected skill areas, significant achievement gains were recorded. Consequently, many researchers have called for a more systematic approach to the teaching of map reading skills in accordance with available suggested skill sequences.

The development of assessment instruments was viewed as being of primary importance for such purposes as the diagnosis of present skill strengths and weaknesses, the monitoring of skill growth, and the comparison of individuals or groups.

The actual development of the testing instrument used in this study was carried out in accordance with test development procedures as outlined by experts in the field. Primary importance during this process was given to the maintenance of a close relationship between the skill objectives and test items and the map reading skills seen as forming an integral part of the social studies curriculum in the Province of Newfoundland and Labrador. The original form of the test was submitted to content and testing specialists, as well as to classroom teachers. A revised Form I of the test was then field tested on a small sample of students. Subsequent analysis of statistical data resulted in further test revisions and the formulation of Form II of the map reading test.

The second form of the test was used to obtain normative data. Using a cluster sampling technique, a sample of ten grade nine geography classes was selected. Two hundred twenty students completed the test. The Statistical Package for the Social Sciences[213] was used to carry out the statistical analysis of the group's scores. A Kuder-Richardson 20 reliability coefficient of .89 was obtained for the test. The students' mean percentage score on the test as a whole was 66 percent.

One of the conclusions drawn from this study was that a relatively valid and reliable test had been developed for assessing the map reading skills of beginning grade nine students in Newfoundland and Labrador.

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[213] N. H. Nie, Statistical Package for the Social Sciences (2nd ed.; New York: McGraw-Hill, Inc., 1975).

The reader was advised to exercise caution when examining the normative data. Data obtained from a large more representative sample would present a more accurate norm group for comparative exercises. The map reading test is also not all-inclusive in that there are skills it may not assess which may be considered to be just as important on a more local basis, such as in a school or school district.

Among the suggestions for further research was one for a study to be conducted, using the test developed, in which the test would be administered to students in lower junior high school and elementary grades. A study to determine the degree of direct correspondence between stated skill objectives and actual classroom practices was also suggested.

To summarize, it is this writer's view that teachers utilizing a sequence of map reading skills can strengthen the map skills of their students. The diagnosis of skill levels, and their meaningful review, together with the application of map reading skills within meaningful social studies contexts, can contribute greatly to an increase in geographic understandings.

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APPENDIX A

Test Plan

Skill Area	Approximate Number of Test Items Desirable in Each Area
Directions	8
Scale	6
Elevation	6
Grid System	10
Location	10
Interpretation	14
Total	54

APPENDIX B

Map Reading Test Objectives

1. The ability to understand and use directions.

a. Given a sketch map of a region without a direction finder to accompany it, the student will correctly identify the top of the map as the part representing the direction North.

b. Given a map, a direction finder, and the position of a point on the map, the student will correctly identify a point located in any of the four cardinal directions from the given position of the original point.

c. Given a map, a direction finder, and the position of a point on the map, the student will correctly identify a point located in any of the four intermediate directions from the given position of the original point.

d. Given a map, a direction finder, and the position of any two points, the student will correctly identify the cardinal direction which would have to be travelled in order to go from one point to the other.

e. Given a map, a direction finder, and the position of any two points on the map, the student will correctly identify the intermediate direction which would have to be travelled in order to go from one point to the other.

2. The ability to understand and use scale.

a. Given a map with a linear scale showing kilometres, the student will choose the answer which best indicates the linear distance between any two points on the map.

b. Given a map with a linear scale showing kilometres, the student will follow a defined path and compute the distance covered and then choose the answer which best indicates the distance covered.

c. Given three sketch maps of different areas and of different scales, the student will compare the maps and choose the statement that best expresses the relationship between the different areas shown on the maps.

3. The ability to understand and use elevation.

a. Given a map showing different elevation levels by means of shading, the student will choose the correct elevation of a given point.

b. Given a map showing different elevation levels by means of shading, the student will choose the correct point for a given elevation.

c. Given a map showing different elevation levels by means of shading, the student will choose the statement which best describes the relationship between the elevation of the land and the courses followed by the rivers on the map.

d. Given a cross sectional profile of an area, the student will choose the cross section of the area which presents the best visualization of the area shown on the relief map.

4. The ability to understand and use a grid system.

a. Given an alphabetical-numerical grid system on a map, and the alphabetical-numerical data describing the position of a place, the student will choose the place described.

b. Given an alphabetical-numerical grid system on a map, the student will choose the correct method for expressing the position of an identified place.

c. Given a map containing lines of latitude, the student will choose the correct method for describing the location of a point on a map in terms of its latitude.

d. Given a map containing lines of longitude, the student will choose the correct method for describing the location of a point on a map in terms of its longitude.

e. Given a map with lines of latitude and longitude marked in degrees, the student will choose the statement that indicates that all points along an indicated line all share the same latitude.

f. Given a map with lines of latitude and longitude marked in degrees, the student will choose the statement that indicates that all points along an indicated line all share the same longitude.

g. Given a map with lines of latitude and longitude marked in degrees, the student will choose the place which names the correct location of a point when the latitude and longitude coordinates for that point are provided.

h. Given a map with lines of latitude and longitude marked in degrees, the student will choose the correct method to be used to name the latitude and longitude of a designated place.

5. The ability to understand and use location.

a. Given a map, the student will be able to locate a specific point by using one or more of the standard semi-pictorial map symbols, such as rivers, lakes, coastlines, roads, mountains, cities, and islands.

b. Given a map, the student will be able to locate a specific point by using the symbols found in the map's legend.

c. Given a map, the student will be able to locate a specific point by using one or more of the unlabelled standard lines of latitude and longitude.

d. Given a map, the student will be able to locate a specific point by using direction and/or distance in order to follow a route of travel.

6. The ability to interpret maps.

a. Given a map, the student will infer from the information on the map man's activities at various locations, and will choose the most appropriate statement that relates the location of a specific place to a specific activity.

b. Given a map containing climatic information, and a description of the climate of a particular area, the student will choose the area that is described.

c. Given a map the student will select from the data shown the information necessary to choose the correct conclusion concerning the relationship between data on the map.

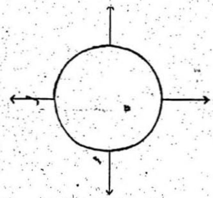
d. Given two or more maps of the same area, the student will combine the data shown, and will choose the correct conclusion to be drawn concerning the relationship between data on the maps.

APPENDIX C

Map Reading Map Booklet Form Ia

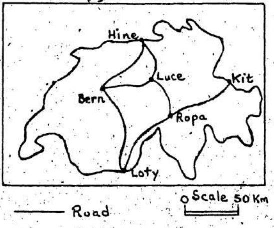
MAP READING TEST

MAP BOOKLET

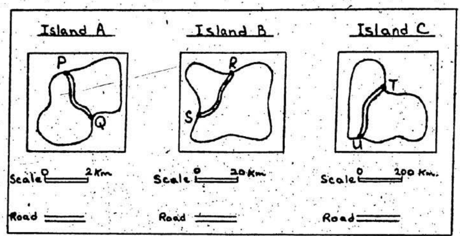


SAMPLE PAGE 1

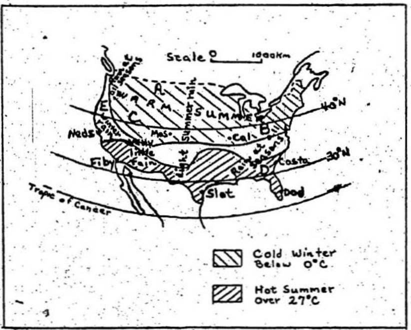
WHITE ISLAND



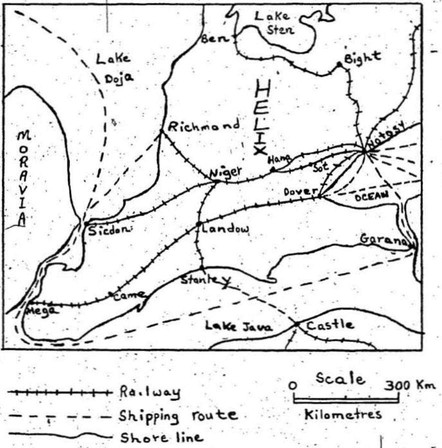
ISLANDS A, B, C.


Island A
P
Q
Scale 0 2 Km
Road
Island B
R
S
Scale 0 20 Km
Road
Island C
T
U
Scale 0 200 Km.
Road

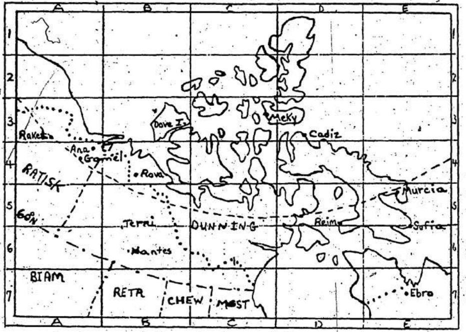
CLIMATE MAP


Scale 0 1000km
A
W A R M
S U M M E R
C
E
B
D
Summer rain
Light
Winter rain
little rain
Rain all seasons
Neds
Fiby
Mas
Cal
Costa
Slat
Dod
40°N
30°N
Tropic of Cancer
Cold Winter Below 0°C
Hot Summer Over 27°C

HELIX MAP


Lake Sten
Ben
Lake Doja
Bight
HELIX
Richmond
MORAVIA
Notosy
Hang
Sot
Niger
Dover
OCEAN
Sicdon
Landow
Garana
Stanley
Came
Mega
Lake Java
Castle
Railway
Shipping route
Shore line
Scale
0
300 Km
Kilometres

WINDSOR LAND



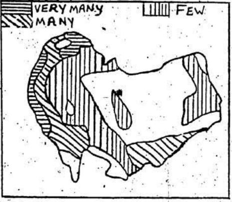
— · — · — Provincial Boundary

• • • • • • • Tree Line

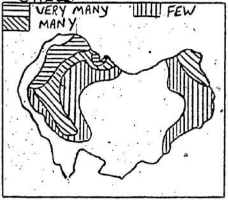
Scale
0 500 Km
Kilometres

SLAVIA

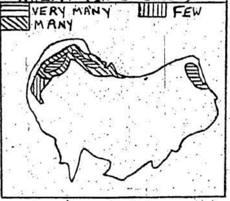
CATTLE



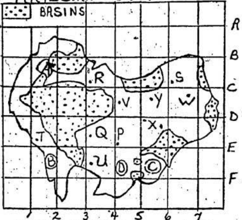
SHEEP



WHEAT (IN BUSHELS)



ARTESIAN BASINS



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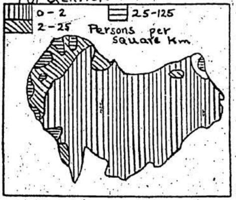
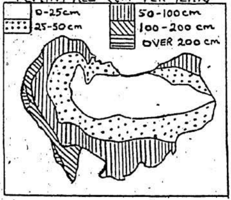
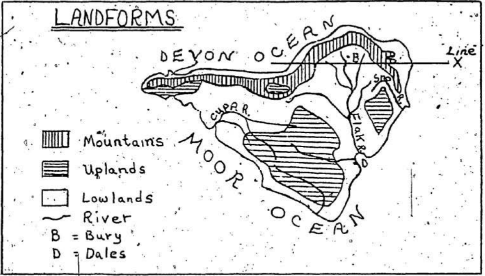
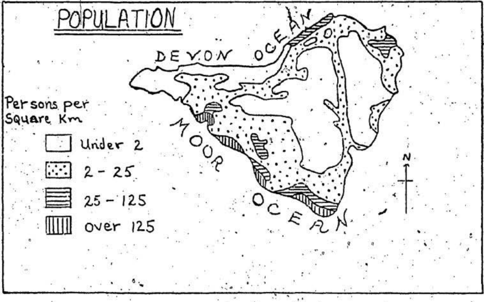


RAINFALL (cm PER YEAR)

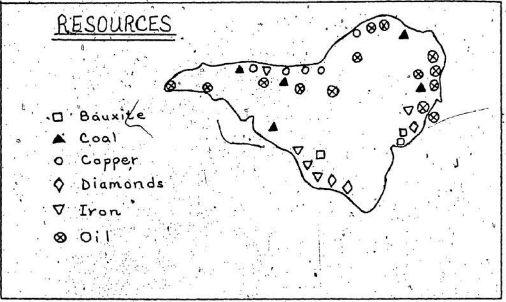


ARISTA


LANDFORMS
DEVON OCEAN
Line X
B
D
Sno R.
Cupa R.
Elak R.
MOOR OCEAN
Mountains
Uplands
Lowlands
River
B = Bury
D = Dales


POPULATION
DEVON OCEAN
MOOR OCEAN
Persons per Square Km
Under 2
2 - 25
25 - 125
over 125
N

ARISTA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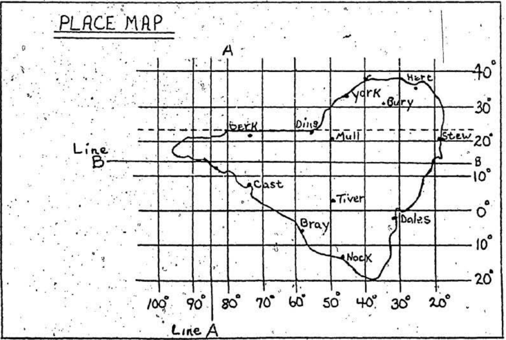
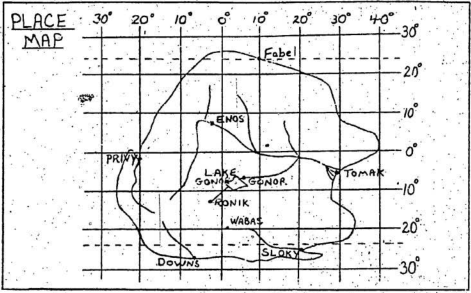
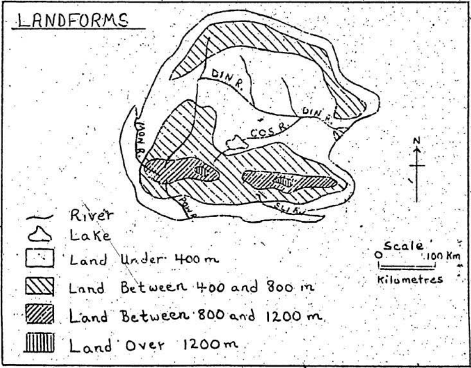
Bauxite
Coal
Copper
Diamonds
Iron
Oil

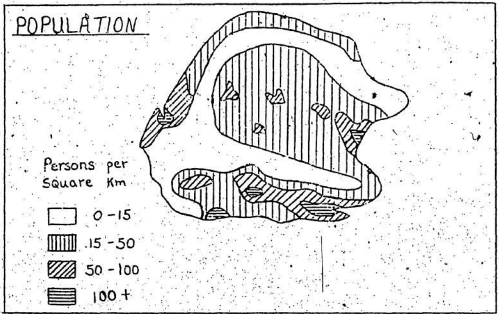

PLACE MAP
A
Line B
B
Line A
Hart
York
Bury
Berk
Ding
Mull
Stew
Cast
Tiver
Dales
Bray
Nock
40°
30°
20°
10°
0°
10°
20°
100°
90°
80°
70°
60°
50°
40°
30°
20°

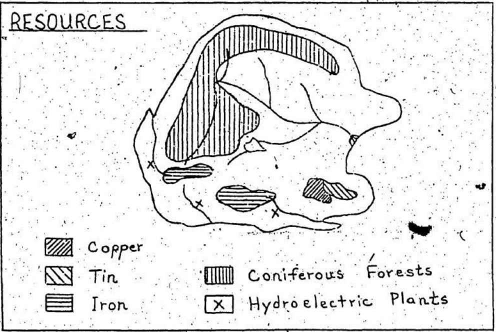
SHALIMO ISLAND





SHALIMO ISLAND





APPENDIX D

Map Reading Question Booklet Form I

M A P R E A D I N G T E S T

QUESTION BOOKLET

Name: ______________________ ______________________
(Family Name) (First Name)

Sex: Please check one. Male ____ Female ____

Age: ____ I was born ____________ ________ ________
(Month) (Day) (Year)

School: ____

Read the questions inside.

Look at the maps in the map booklet.

Mark your answers in this booklet.

DIRECTIONS TO THE STUDENT

READ THIS PAGE CAREFULLY BEFORE YOU START YOUR WORK

This is a test of your ability to read maps. It contains several maps in a separate map booklet. There are questions about the maps in this question booklet. Both of these booklets are to be used at the same time.

You will have to refer to one or more maps in the map booklet in order to answer the questions in the question booklet. Read each question carefully and make sure you are looking at the correct map. Each question has four choices. The letters a, b, c, and d are written to the left of each choice. Circle the letter which you think provides the best answer available. Here is a sample question:

Use the map on sample page 1 of your test booklet in order to answer the question below.

1. Which town is closest to Bern?

   a. Basel
   b. Luce
   c. Ropa
   d. Hine

Of course, you would circle b, because it is the best answer available from the four choices.

Use the pencil to write your answers in the test booklet. Work as carefully but as quickly as you can. Do not spend too much time on a difficult question. You can always go back to questions you leave out, if you have time.

If you have any questions, ask them now.

Look inside your map booklet and find page 1. Use the maps of Islands A, B, and C to answer questions 1 and 2 below.

1. There are three small sketch maps showing Islands A, B, and C. Which island covers the largest area?
   a. Island A
   b. Island B
   c. Island C
   d. They all cover about the same area.

2. Which places are nearest to each other by road?
   a. Points P and Q
   b. Points R and S
   c. Points T and U
   d. All points are about the same distance apart.

Find the Climate Map on Page 2 of your map booklet. Use that map in order to answer questions 3 to 8.

3. What is the approximate distance from Slot to Cal?
   a. 1400 Km
   b. 2200 Km
   c. 3000 Km
   d. 3800 Km

4. If you boarded an airplane at Mos and flew west to the nearest city then flew southeast about 4500 Km and landed, at what city would you end your trip?
   a. Slot
   b. Fiby
   c. Costa
   d. Dod

5. If you flew from Costa to Cal, then to Mos and finally to Neds, how far would you have travelled?
   a. 6000 Km
   b. 7000 Km
   c. 8000 Km
   d. 9000 Km

6. Which of the following best describes the location of Dod?
   a. 34° North latitude
   b. 34° South latitude
   c. 26° North latitude
   d. 26° South latitude

7. Which area on the map may be described as follows: warm summer, very cold winter, not much rain?
   a. Area A
   b. Area B
   c. Area C
   d. Area D

8. Which of the following statements best describes the climate of Area E?
   a. Warm dry summer; wet mild winters
   b. Warm and moist all year round
   c. Hot, very dry summer; cool, dry winter
   d. Warm summer, rather cold winter; moist all year round

Study carefully the map of Helix on page 3 of the map booklet. Use it to answer questions 9 to 12.

9. In what direction is North on this map?
   a. Towards the top of the map
   b. Towards the bottom of the map
   c. Towards the right side of the map
   d. Towards the left side of the map

10. Approximately how far is it from Notosy to Stanley by water?

    a. 1100 Km
    b. 1700 Km
    c. 2300 Km
    d. 2900 Km

11. Which city on this map would most likely be the main shipping center for this region?

    a. Niger
    b. Dover
    c. Landow
    d. Notosy

12. If you boarded a train at Landow and then travelled about 120 Km to a port and then travelled by ship to the nearest port, at what place would you finally land?

    a. Richmond
    b. Sicdon
    c. Stanley
    d. Castle

Turn to page 4 of the map booklet and find the map of Windsor Land. Use it to answer questions 13 to 18.

13. What is the length of Dove Island at its longest point?
    a. 250 Km
    b. 400 Km
    c. 550 Km
    d. 700 Km

14. What is the grid location of Nantes?
    a. B-6
    b. C-4
    c. A-5
    d. B-5

15. What is the name of the settlement found in grid A-4?
    a. Meky
    b. Raket
    c. Ana
    d. Murcia

16. Which town is located South of the tree line?
    a. Rova
    b. Cadiz
    c. Terni
    d. Sofia

17. Which of these settlements is located closest to the North Pole?

a. Sofia

b. Reim

c. Rova

d. Gramel

18. At which of the following places would you have least difficulty finding fuel for a wood fire?

a. Terni

b. Meky

c. Rova

d. Sofia

On page 5 of the map booklet there are six maps of Slavia. You may have to refer to one or more of these maps in order to answer each of the questions 19 to 26.

19. Look at the Artesian Basins map of Slavia. What is the approximate grid location of point P?

a. F-5

b. E-4

c. D-3

d. C-3

20. What is the name of the point nearest to D-5?
    a. Point S
    b. Point W
    c. Point X
    d. Point Y

21. Where do most of the people in Slavia live? Most of them live along the:
    a. Southeast coast
    b. Northwest coast
    c. Southwest coast
    d. North coast

22. Look at the maps showing the distribution of rainfall and sheep. How many centimetres of rainfall a year seems best suited for the raising of sheep in Slavia?
    a. 25-50 cm
    b. 50-100 cm
    c. 100-200 cm
    d. Over 200 cm

23. Which area could best be described as being in a wheat and sheep belt?
    a. Area A
    b. Area B
    c. Area C
    d. Area D

24. Pineapples require plenty of rainfall and warm temperatures. In which part of Slavia would you expect pineapples to be grown, if it is warm year round in Slavia?

a. Along the southeast coast

b. Along the north coast

c. Along the east coast

d. Along the southwest coast

25. Note carefully the distribution of cattle and sheep in Slavia. What factor enables some sheep and cattle to be raised in relatively dry areas?

a. Artesian basins

b. Few people

c. Wheat growing

d. Flat plains

26. Which area of Slavia appears to be most highly developed?

a. The central region

b. The western region

c. The eastern region

d. The northern region

STOP STOP

YOU HAVE FINISHED THE FIRST PART OF THIS TEST. IF YOU HAVE TIME LEFT, YOU MAY GO BACK AND CHECK YOUR WORK. IF YOUR WORK IS FINISHED AND CHECKED CLOSE THIS BOOKLET AND THE MAP BOOKLET.

On pages 6 and 7 of the map booklet there are four maps of Arista. Study these maps carefully. You may have to refer to one or more of these maps in order to answer questions 27 to 44.

27. In which of the following areas do most of the people of Arista live?
    a. In the central part of Arista
    b. Along the parts of Arista that border on the Moor ocean
    c. Along the Flak River
    d. Along the parts of Arista that border on the Devon Ocean

28. Which of the following cities has the highest elevation?
    a. Stew
    b. Dales
    c. Mull
    d. Cast

29. Which of the following statements best describes the elevation of Tiver?

    a. It is located in the mountains.
    b. It is located in an upland area.
    c. It is located on a lowland area.
    d. It is located below sea level.

30. Which of the following would provide the most difficulty in building a road directly from Bury to Dales?

    a. Rivers have to be crossed.
    b. Mountains have to be crossed.
    c. A large desert has to be crossed.
    d. Rivers, mountains, and deserts would have to be crossed.

31. Follow the courses of the Cupa, Flak, and Sno Rivers. What do the courses of these rivers tell you about the direction in which most of the land in Arista slopes? Most land slopes towards the:

    a. Moor Ocean
    b. Devon Ocean
    c. Line X
    d. City of Mull

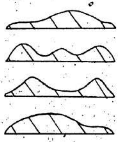
32. One of the diagrams below represents a cross section of Arista taken from left to right along line X. Which diagram best represents the shape of the land?

a.

b.

c.

d.



33. In what direction does Nock lie from York?

a. North

b. South

c. East

d. West

34. Dales lies in what direction from Mull?

a. Northeast

b. Northwest

c. Southeast

d. Southwest

35. Which of the following best describes the location of Dales?

a. 32° North longitude

b. 2° South longitude

c. 2° East longitude

d. 32° West longitude

36. What do all points along line A share in common? They all share the same:

a. Elevation

b. Latitude

c. Temperature

d. Longitude

37. What do all points along line B share in common? They all share the same:

a. Elevation

b. Latitude

c. Temperature

d. Longitude

38. In what approximate direction would you be going if you flew from Stew to Berk?

a. North

b. South

c. East

d. West

39. In what approximate direction would you be going if you flew from Cast to Hart?

a. Northeast

b. Northwest

c. Southeast

d. Southwest

40. Which city is located nearest to Lat. 5^{o}S Long. 58^{o}W?

a. Tiver

b. Nock

c. Bray

d. Cast

41. Which statement below best describes the position of Hart?

a. Lat. 35^{o}N Long. 35^{o}E

b. Lat. 35^{o}N Long. 25^{o}W

c. Lat. 35^{o}S Long. 35^{o}E

d. Lat. 35^{o}S Long. 35^{o}W

42. Which city is most likely to be an exporter of diamonds?
    a. Nock
    b. Hart
    c. Berk
    d. Cast

43. Which city would appear to be the most important center for oil production?
    a. Stew
    b. York
    c. Tiver
    d. Dales

44. Which city is located nearest to the equator?
    a. Stew
    b. Dales
    c. Mull
    d. Ding

On pages 8 and 9 of the map booklet there are four maps of the Island of Shalimo. Study these maps carefully. You may have to refer to one or more of these maps in order to answer questions 45 to 70.

45. In what direction does Privy lie from Tomak?

a. North

b. South

c. East

d. West

46. Gonor lies in what direction from Ronik?

a. Northeast

b. Northwest

c. Southeast

d. Southwest

47. If you sailed from Tomak to Enos approximately how far would you travel?

a. 250 Km

b. 350 Km

c. 450 Km

d. 550 Km

48. If you flew by airplane from Wabas to Tomak, and then sailed from Tomak to Gonor, about how many total kilometres would you travel?

a. 300 Km

b. 400 Km

c. 500 Km

d. 600 Km

49. What is the approximate elevation of Gonor?
    a. Under 400 m
    b. Between 400 and 800 m
    c. Between 800 and 1200 m
    d. Over 1200 m

50. Which of the following cities has an elevation between 400 and 800 m?
    a. Fabel
    b. Tomak
    c. Ronik
    d. Sloky

51. Which statement best describes the position of Wabas?
    a. 20° North latitude
    b. 2° East latitude
    c. 20° South latitude
    d. 2° West latitude

52. How may the position of Sloky be best described?
    a. 20° North longitude
    b. 20° East longitude
    c. 25° South longitude
    d. 25° West longitude

53. Which city is located nearest to a lake?

a. Tomak

b. Ronik

c. Gonor

d. Wabas

54. Which city is located nearest to a mountain peak?

a. Ronik

b. Sloky

c. Privy

d. Gonor

55. Which river flows into another river?

a. Cos

b. Pow

c. Sli

d. Mon

56. Why are hydroelectric plants located where they are?

a. They are near iron deposits.

b. There are cities nearby.

c. Fast flowing rivers are available.

d. They are all on the same side of the island.

57. The making of bronze requires the use of tin and copper. Which city would be most likely to manufacture bronze?
    a. Gonor
    b. Enos
    c. Privy
    d. Sloky

58. Which city would probably be most likely to experience Spring flooding?
    a. Tomak
    b. Privy
    c. Wabas
    d. Ronik

59. In what direction would you be going if you flew from Downs to Enos?
    a. North
    b. South
    c. East
    d. West

60. In what approximate direction would you be going if you flew from Fabel to Tomak?

a. Northeast

b. Northwest

c. Southeast

d. Southwest

61. The river Mon follows the route it does because:

a. It flows from high to low land.

b. It starts in an area where iron is found.

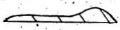
c. It passes through the city of Privy.

d. All the rivers on the island flow in almost the same direction.

62. A cross section of the island of Shalimo straight from Privy to Tomak would show the shape of the land to be most like:

a. P  T

b. P  T

c. P  T

d. P  T

63. Which city is located nearest to Lat. 12°S Long. 3°W?

a. Ronik

b. Gonor

c. Wabas

d. Enos

64. Which statement below best describes the position of the city of Tomak?

a. 5°N 29°E

b. 5°N 29°W

c. 5°S 29°E

d. 5°S 29°W

65. Which city is located closest to a hydroelectric plant?

a. Fabel

b. Enos

c. Gonor

d. Privy

66. Which city is located closest to the Prime Meridian?

a. Sloky

b. Privy

c. Enos

d. Fabel

67. Which city would probably be a mining center?

a. Tomak

b. Fabel

c. Wabas

d. Downs

68. Which city would probably have the most saw mills and lumber yards?

a. Wabas

b. Privy

c. Sloky

d. Enos

69. Which city probably has the smallest population?

a. Privy

b. Fabel

c. Downs

d. Sloky

70. What is true about the four cities of Enos, Gonor, Sloky, and Privy? They are all:

a. Located on the coast

b. About the same size in population

c. Situated on rivers

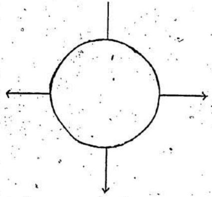
d. Probably mining towns

A P P E N D I X D

Map Reading Map Booklet Form Ib

M A P R E A D I N G T E S T

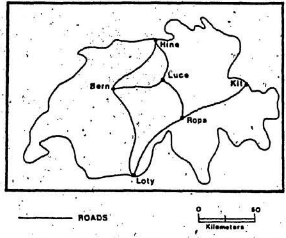
MAP BOOKLET



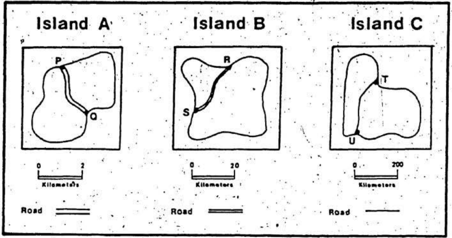
Refer to the maps in this booklet in order to answer the questions in the Question Booklet.

Sample Page 1

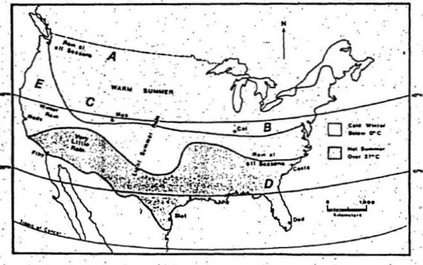
White Island



Islands A,B,C

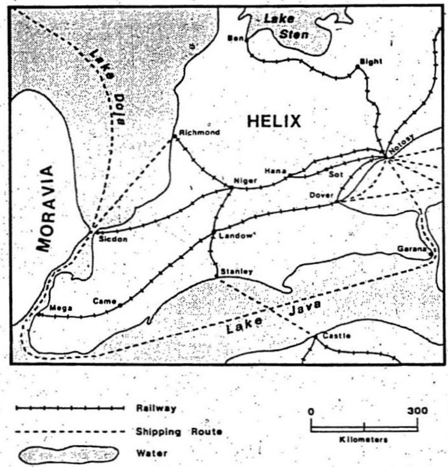

Island A
P
Q
0
2
Kilometers
Road
Island B
R
S
0
20
Kilometers
Road
Island C
T
U
0
200
Kilometers
Road

Climate Map

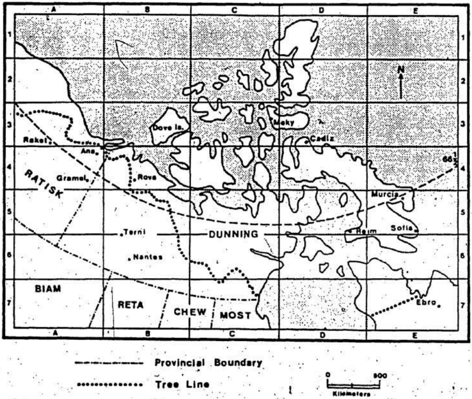


This map has been reduced to seventy-five percent of its original size.

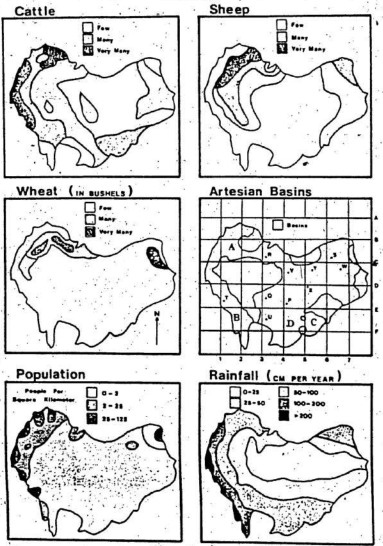
HELIX MAP


Lake Sten
Ben
Bight
Lake Dola
HELIX
Richmond
Notosy
Hana
Sot
Niger
Dover
MORAVIA
Sicdon
Landow
Garana
Stanley
Came
Mega
Java
Lake
Castle
Railway
Shipping Route
Water
0
300
Kilometers

WINDSOR LAND

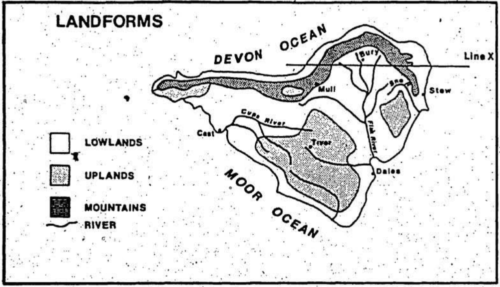


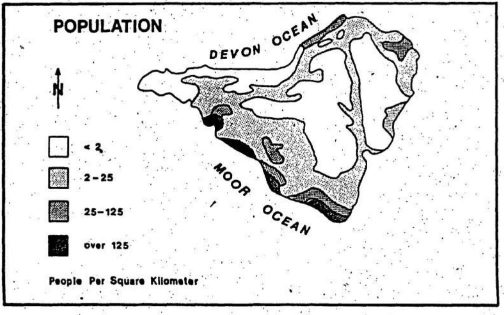
SLAVIA



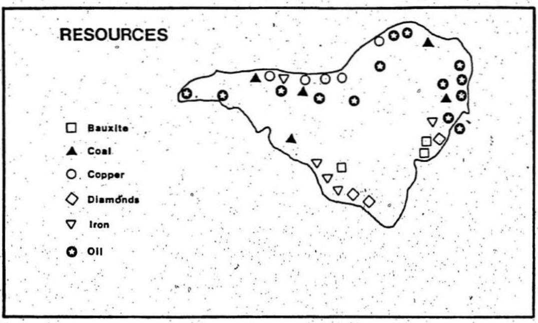
These maps have been reduced to seventy-five percent of their original size.

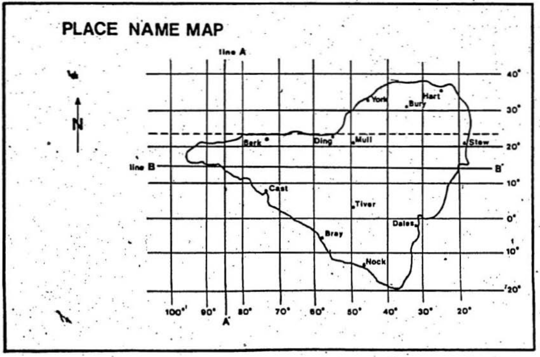
ARISTA


LANDFORMS
DEVON OCEAN
MOOR OCEAN
Line X
Bury
Mull
Stew
Cupe River
Cast
Tiver
Fish River
Dales
LOWLANDS
UPLANDS
MOUNTAINS
RIVER

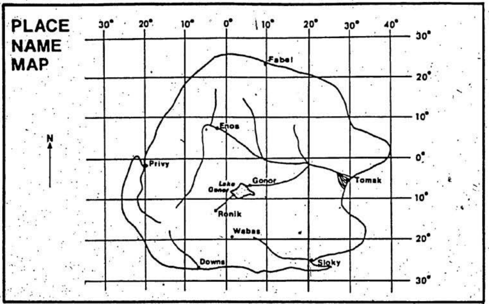

POPULATION
DEVON OCEAN
MOOR OCEAN
N
< 2
2 - 25
25-125
over 125
People Per Square Kilometer

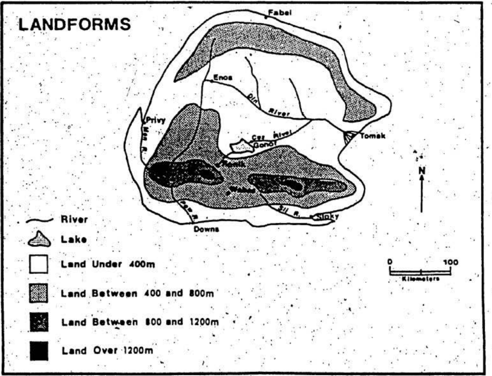
ARISTA


RESOURCES
Bauxite
Coal
Copper
Diamonds
Iron
Oil

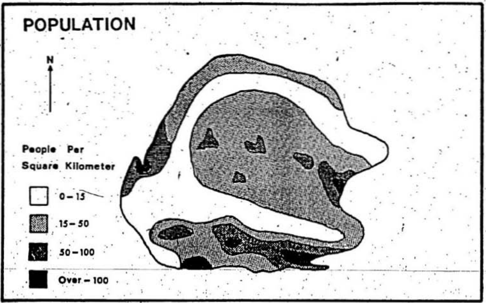

PLACE NAME MAP
N
line A
line B
A'
B'
York
Hart
Bury
Bark
Ding
Mull
Stew
Cast
Tiver
Dales
Bray
Nock
40°
30°
20°
10°
0°
10°
20°
100°
90°
80°
70°
60°
50°
40°
30°
20°

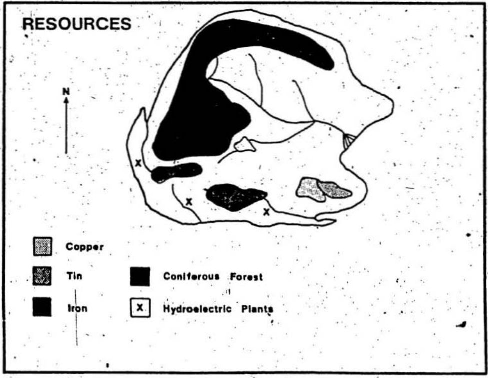
SHALIMO ISLAND





SHALIMO ISLAND





APPENDIX E

Map Reading Question Booklet Form II

M A P R E A D I N G T E S T

QUESTION BOOKLET

Name: ______________________ ______________________
(Family Name) (First Name)

Sex: Please check one. Male ______ Female ______

Age: __________. I was born __________ ______ ______
(Month) (Day) (Year)

School: ____

Read the questions inside.

Look at the maps in the map booklet.

Mark your answers in this booklet.

READ THIS PAGE CAREFULLY BEFORE YOU START YOUR WORK

This is a test of your ability to read maps. It contains several maps in a separate map booklet. There are questions about the maps in this question booklet. Both of these booklets are to be used at the same time.

You will have to refer to one or more maps in the map booklet in order to answer the questions in the question booklet. Read each question carefully and make sure you are looking at the correct map. Each question has four choices. The letters a, b, c, and d are written to the left of each choice. Circle the letter which you think provides the best answer available.

Here is a sample question:

Use the map on sample page 1 of your test booklet in order to answer the question below.

1. Which town is closest to Bern?
   a. Basel
   b. Luce
   c. Ropa
   d. Hine

Of course, you would circle b, because it is the best answer available from the four choices.

Use a pencil to write your answers in the test booklet. Work as carefully but as quickly as you can. Do not spend too much time on a difficult question. You can always go back to questions you leave out, if you have time.

If you have any questions, ask them now.

Look inside your map booklet and find page 1. Study carefully the map of Helix on page 1 of the map booklet. Use it to answer questions 1 and 2.

1. In what direction is North on this map?
   a. Towards the top of the map
   b. Towards the center of the map
   c. Towards the right side of the map
   d. Towards the left side of the map

2. If you boarded a train at Landow and then travelled about 120 Km to a port and then travelled by ship to the nearest port, at what place would you finally land?
   a. Notosy
   b. Sicdon
   c. Stanley
   d. Castle

Find the Climate Map on page 2 of your map booklet. Use that map in order to answer questions 3 to 6.

3. If you boarded an airplane at Mos and flew west to the nearest city then flew southeast about 4500 Km and landed, at what city would you end your trip?

   a. Slot

   b. Fiby

   c. Costa

   d. Dod

4. If you flew from Costa to Cal, then to Mos and finally to Neds, how far would you have travelled?

   a. 6000 Km

   b. 7000 Km

   c. 8000 Km

   d. 9000 Km

5. Which of the following best describes the location of Dod?

   a. 34^{o} North latitude

   b. 34^{o} South latifude

   c. 26^{o} North latitude

   d. 26^{o} South latitude

6. Which area on the map may be described as follows: warm summer, very cold winter, not much rain?
   a. Area A
   b. Area B
   c. Area C
   d. Area D

Turn to page 3 of your map booklet and find the maps of Islands A, B, and C. Use these maps to answer questions 7 and 8 below.

7. There are three small sketch maps showing Islands A, B, and C. Which island covers the largest area:
   a. Island A
   b. Island B
   c. Island C
   d. They all cover about the same area

8. Which places are nearest to each other by road?
   a. Points P and Q
   b. Points R and S
   c. Points T and U
   d. All points are about the same distance apart.

Turn to page 4 of the map booklet and find the map of Windsor Land. Use it to answer question 9 to 11.

9. What is the length of Dove Island at its longest point?
   a. 250 Km
   b. 400 Km
   c. 550 Km
   d. 700 Km

10. Which town is located South of the tree line?
   a. Rova
   b. Reim
   c. Terni
   d. Sofia

11. Which of these settlements is located closest to the North Pole?
   a. Sofia
   b. Murcia
   c. Rova
   d. Gramel

On pages 5 and 6 of the map booklet there are four maps of Arista. Study these maps carefully. You may have to refer to one or more of these maps in order to answer questions 12 to 28.

12. In which of the following areas do most of the people of Arista live?

    a. In the central part of Arista

    b. Along the parts of Arista that border on the Moor Ocean

    c. Along the Cupa River

    d. Along the parts of Arista that border on the Devon Ocean

13. Which of the following cities has the highest elevation?

    a. Tiver

    b. Dales

    c. Mull

    d. Cast

14. Which of the following cities could be described as being in an upland area:

    a. Mull

    b. Tiver

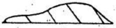
    c. Bury

    d. Dales

15. Which of the following would provide the most difficulty in building a road directly from Bury to Dales?
   a. Rivers have to be crossed.
   b. Mountains have to be crossed.
   c. A large desert has to be crossed.
   d. Rivers, mountains, and deserts would have to be crossed.

16. Follow the courses of the Cupa, Flak and Sno Rivers. What do the courses of these rivers tell you about the direction in which most of the land in Arista slopes? Most land slopes toward the:
   a. Moor Ocean
   b. Devon Ocean
   c. Line X
   d. City of Mull

17. One of the diagrams below represents a cross section of Arista taken from left to right along line X. Which diagram best represents the shape of the land?

a. 

b. 

c. 

d. 

18. In what direction does Nock lie from York?

a. North

b. East

c. South

d. West

19. Dales lies in what direction from Mull?

a. Northeast

b. Northwest

c. Southeast

d. Southwest

20. Which of the following best describes the location of Dales?

    a. 32° North longitude

    b. 2° South longitude

    c. 2° East longitude

    d. 32° West longitude

21. What do all points along line A share in common? They all share the same:

    a. Elevation

    b. Latitude

    c. Temperature

    d. Longitude

22. What do all points along line B share in common? They all share the same:

    a. Elevation

    b. Latitude

    c. Temperature

    d. Longitude

23. In what approximate direction would you be going if you flew from Stew to Berk?

    a. North
    b. East
    c. South
    d. West

24. In what approximate direction would you be going if you flew from Cast to Hart?

    a. Northeast
    b. Northwest
    c. Southeast
    d. Southwest

25. Which city is located nearest to Lat. 5°S Long. 58°W?

    a. Tiver
    b. Nock
    c. Bray
    d. Cast

26. Which statement below best describes the position of Hart?

    a. Lat. 35°N Long. 35°E
    b. Lat. 35°N Long. 25°W
    c. Lat. 35°S Long. 25°E
    d. Lat. 35°S Long. 35°W

27. Which city is most likely to be an exporter of diamonds?
    a. Berk
    b. Bray
    c. Ding
    d. Nock

28. Which city is located nearest to the equator?
    a. Stew
    b. Dales
    c. Mull
    d. Ding

STOP STOP

YOU HAVE FINISHED THE FIRST PART OF THIS TEST. IF YOU HAVE TIME LEFT YOU MAY GO BACK AND CHECK YOUR WORK. IF YOUR WORK IS FINISHED AND CHECKED, CLOSE THIS BOOKLET AND THE MAP BOOKLET

On page 7 of the map booklet there are six maps of Slavia. You may have to refer to one or more of these maps in order to answer each of the questions 29 to 36.

29. Look at the Artesian Basins Map of Slavia. What is the approximade grid location of point P?

a. F-4

b. E-4

c. D-4

d. D-3

30. What is the name of the point nearest to D-5?

a. Point P

b. Point V

c. Point X

d. Point Y

31. Where do most of the people in Slavia live? Most of them live along the:

a. Southeast coast

b. Northwest coast

c. Northeast coast

d. North coast

32. Look at the maps showing the distribution of rainfall and sheep. How many centimetres of rainfall a year seems best suited for the raising of sheep in Slavia?

a. 25-50 cm

b. 50-100 cm

c. 100-200 cm

d. Over 200 cm

33. Which area could best be described as being in a wheat and sheep belt?

a. Area A

b. Area B

c. Area C

d. Area D

34. Pineapples require plenty of rainfall and warm temperatures. In which part of Slavia would you expect pineapples to be grown, if it is warm year round in Slavia?

a. Along the southeast coast

b. Along the north coast

c. Along the east coast

d. Along the southwest coast

35. Note carefully the distribution of cattle and sheep in Slavia. What factor enables some sheep and cattle to be raised in relatively dry areas?

a. Artesian basins

b. Few people

c. Wheat growing

d. Flat plains

36. Which area of Slavia appears to be most highly developed?

a. The central region

b. The western region

c. The eastern region

d. The northern region

On pages 8 and 9 of the map booklet, there are four maps of the Island of Shalimo. Study these maps carefully. You may have to refer to one or more of these maps in order to answer questions 37 to 60.

37. In what direction does Privy lie from Tomak:

a. North

b. East

c. South

d. West

38. Gonor lies in what direction from Ronik?

a. Northeast

b. Northwest

c. Southeast

d. Southwest

39. If you sailed from Tomak to Enos approximately how far would you travel?

a. 250 Km

b. 350 Km

c. 450 Km

d. 550 Km

40. If you flew by airplane from Wabas to Tomak, and then sailed from Tomak to Gonor, about how many total kilometres would you travel?

a. 300 Km

b. 400 Km

c. 500 Km

d. 600 Km

41. What is the approximate elevation of Gonor?

a. Under 400 m

b. Between 400 and 800 m

c. Between 800 and 1200 m

d. Over 1200 m

42. Which of the following cities has an elevation between 400 and 800 m?
    a. Fabel
    b. Tomak
    c. Ronik
    d. Sloky

43. Which statement best describes the position of Wabas?
    a. 20° North latitude
    b. 2° East latitude
    c. 20° South latitude
    d. 2° West latitude

44. How may the position of Sloky be best described?
    a. 20° North longitude
    b. 20° East longitude
    c. 25° South longitude
    d. 25° West longitude

45. Which city is located nearest to a mountain peak?
    a. Ronik
    b. Wabas
    c. Privy
    d. Sloky

46. Which river flows into a lake?

a. Din

b. Sli

c. Mon

d. Cos

47. Why are hydroelectric plants located where they are?

a. They are near iron deposits.

b. There are cities nearby.

c. Fast flowing rivers are available.

d. They are all located near the coast.

48. The making of bronze requires the use of tin and copper. Which city would be most likely to manufacture bronze?

a. Gonor

b. Enos

c. Downs

d. Sloky

49. Which city would probably be most likely to experience spring flooding?

a. Tomak

b. Privy

c. Wabas

d. Ronik

50. In what approximate direction would you be going if you flew from Fabel to Tomak?

a. Northeast

b. Northwest

c. Southeast

d. Southwest

51. The river Mon follows the route it does because:

a. It flows from high to low land.

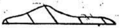
b. It starts in an area where iron is found.

c. It passes through the city of Privy.

d. All the rivers on the island flow in almost the same direction.

52. A cross section of the island of Shalimo straight from Privy to Tomak would show the shape of the land to be most like:

a. P  T

b. P  T

c. P  T

d. P  T

53. Which city is located nearest to Lat. 12°S Long. 3°W?

a. Ronik

b. Gonor

c. Wabas

d. Downs

54. Which statement below best describes the position of the city of Tomak?

a. 5°N 29°E

b. 5°N 29°W

c. 5°S 29°E

d. 5°S 29°W

55. Which city is located closest to a hydroelectric plant?

a. Fabel

b. Enos

c. Ronik

d. Privy

56. Which city is located closest to the Prime Meridian?

a. Sloky

b. Privy

c. Enos

d. Fabel

57. Which city would probably be a mining center?

a. Ronik

b. Fabel

c. Wabas

d. Gonor

58. Which city would probably have the most saw mills and lumber yards?

a. Wabas

b. Privy

c. Sloky

d. Enos

59. Which city probably has the smallest population?

a. Privy

b. Fabel

c. Downs

d. Sloky

60. What is true about the four cities of Enos, Gonor, Sloky and Privy? They are all:

a. Located south of the equator.

b. About the same size in population.

c. Situated on rivers.

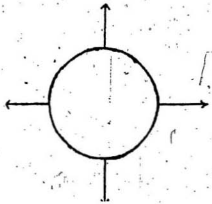
d. Probably mining towns.

APPENDIX E

Map Reading Map Booklet Form II

MAP READING TEST

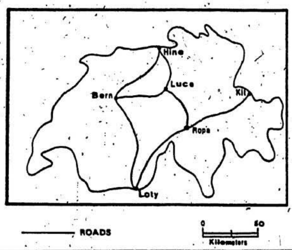
MAP BOOKLET



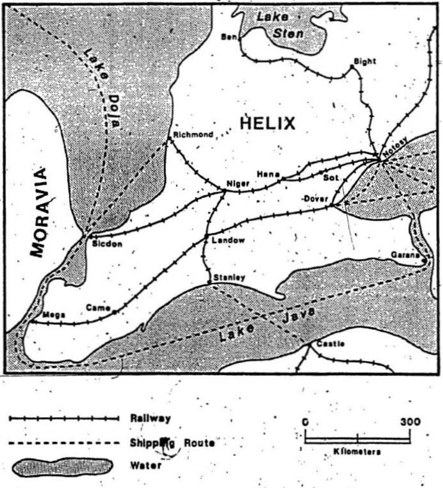
Refer to the maps in this booklet in order to answer the questions in the Question Booklet.

Sample Page 1

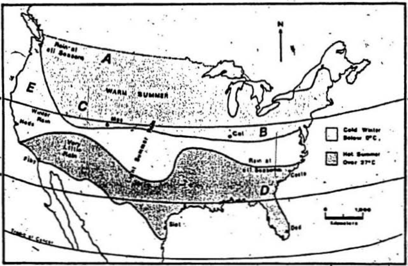
White Island



HELIX MAP

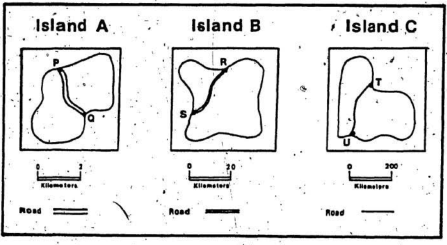

Lake Sten
Ben
Bight
Lake Doja
HELIX
Richmond
Hotosy
MORAVIA
Hana
Sot
Niger
Dover
Sicdon
Landow
Garana
Stanley
Mega
Came
Lake Java
Castle
Railway
Shipping Route
Water
0
300
Kilometers

Climate Map

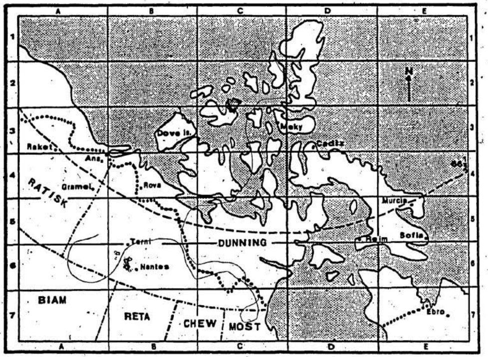


This map has been reduced to seventy-five percent of its original size.

Islands A,B,C


Island A
P
Q
0
2
Kilometers
Road
Island B
R
S
0
20
Kilometers
Road
Island C
T
U
0
200
Kilometers
Road

WINDSOR LAND

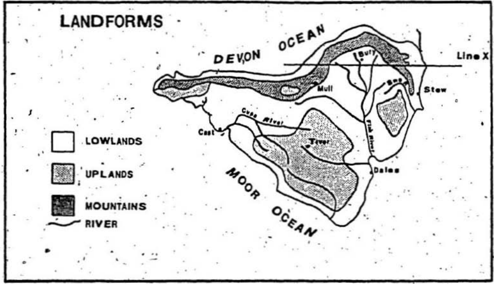


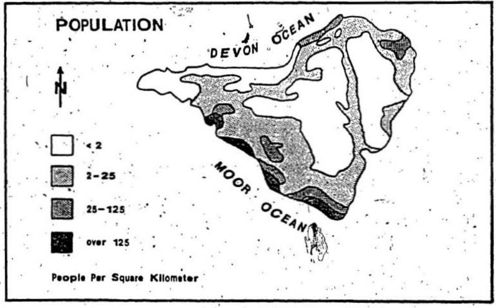
Provincial Boundary

Tree Line

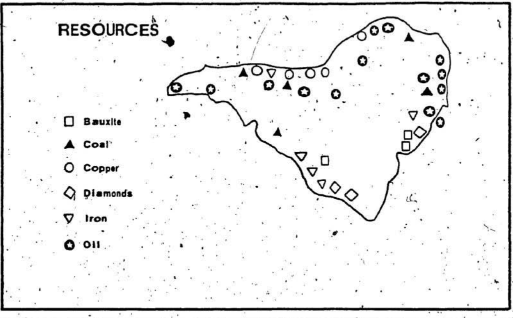
0 500 Kilometers

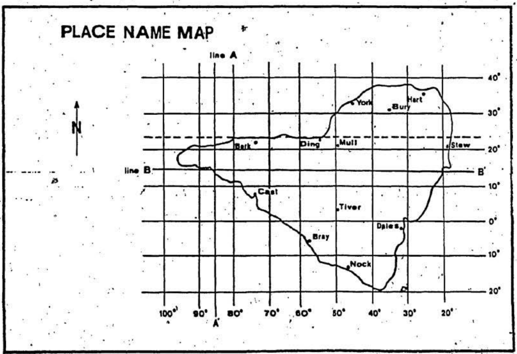
ARISTA


LANDFORMS
DEVON OCEAN
Line X
Bury
Mull
Stew
Cast
Tiver
Dales
Cuse River
Fish River
MOOR OCEAN
LOWLANDS
UPLANDS
MOUNTAINS
RIVER

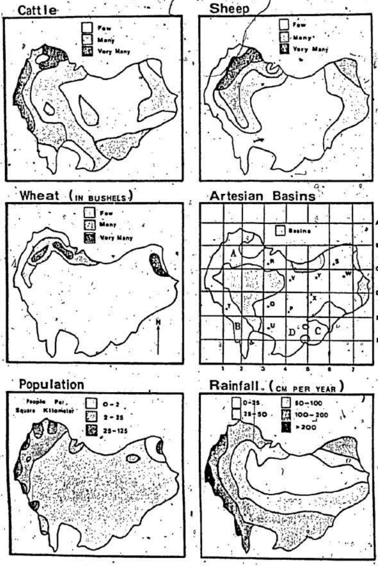

POPULATION
DEVON OCEAN
N
MOOR OCEAN
< 2
2–25
25–125
over 125
People Per Square Kilometer

ARISTA


RESOURCES
Bauxite
Coal
Copper
Diamonds
Iron
Oil

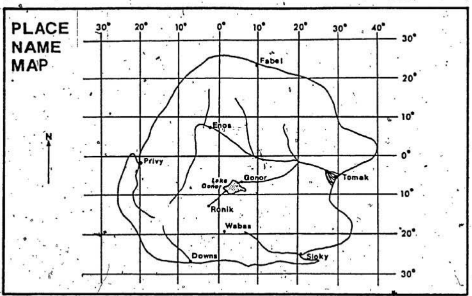

PLACE NAME MAP
N
line A
line B
B'
A'
York
Bury
Hart
Bark
Ding
Mull
Stew
Cast
Tiver
Dales
Bray
Nock
40°
30°
20°
10°
0°
10°
20°
100°
90°
80°
70°
60°
50°
40°
30°
20°

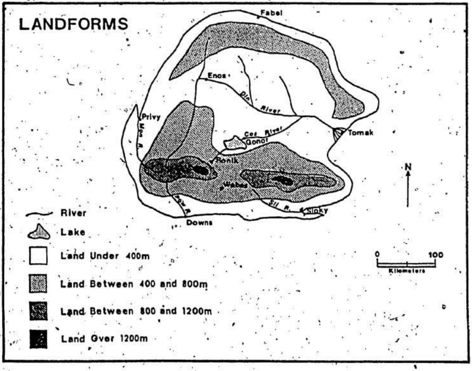
SLAVIA



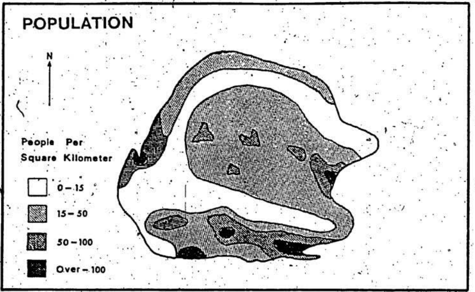
These maps have been reduced to seventy-five percent of their original size.

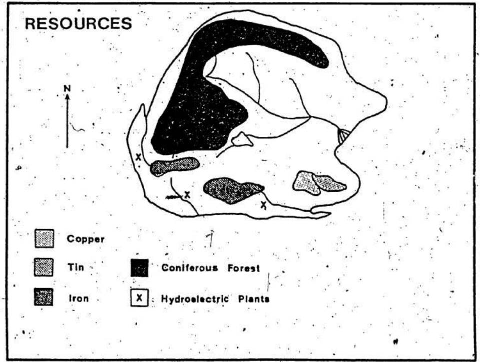
SHALIMO ISLAND





SHALIMO ISLAND





APPENDIX F

Teacher's Manual for Administration of Form I of the Test

TEACHER'S DIRECTIONS

FOR ADMINISTERING

THE GRADE EIGHT

MAP READING TEST

Scheduling the Test

This test administration by you as a teacher to grade eight geography students constitutes an initial try out of the items developed for this map reading test. It is important that students be given an opportunity to try most, if not all, of the items on the test. For this reason the map reading test should be administered in two forty-minute sessions. The first session will involve twenty-six items in the map reading test. The second session will give the students an opportunity to complete test items 27 to 70. It is therefore very important that students close their test question booklets and map booklets after completing item 26 in the first session.

In an ideal situation session one should be followed by session two. A rest period of five minutes should be provided between the two sessions. If the two sessions cannot follow each other immediately then the first may be given one day and the second session should be administered the following day.

Preparing for Test Administration

The examiner should make sure that each student has the following materials during a testing session.

(a) A question booklet

(b) A map booklet

(c) A pencil

(d) A sheet of plain paper or ruler which can be used for measuring distance.

Try to maintain a natural classroom atmosphere. Encourage students to do their best on the tests. However, avoid overemphasizing the importance of the tests because the students might become nervous about them.

Please make sure you are familiar with the directions to the teacher and the directions to the student.

The nature of the students' responses are essential for the further refinement and revision of this test based on a comprehensive statistical analysis. In the actual research report no reference will be made to individual students, teachers, or schools. The personal data obtained will be held in the strictest confidence. Even though the names of the students will not be revealed they are required on the test question booklet because it is important that the test serve as an accurate measure of student performance. By requiring a student to write his name on a test, he will be strongly motivated to perform his best. If students' names were not required on the test booklet it is felt that the anonymity of student responses may result in a less than best effort by many students. I cannot therefore overemphasize that names will remain anonymous and that confidentiality will be a prime consideration at all times.

Administering the Tests

Session One

After the students are seated in the desired arrangement for the testing session, distribute the map reading question booklet and map booklet. Check to ensure that each student has a pencil and a sheet of paper or ruler for measuring. The map booklets and question booklets should remain closed on the students' desks. Speak slowly and clearly and say:

> We are now going to begin taking the Map Reading Test for Grade Eight students. It is very important that you do your best on this test. The test will show how well you are doing in map reading. It will also show the areas in which you need more help. So make the tests give a good picture of your map reading skills by doing the best you can on each question.
>
> The test will be given in two parts. You will have thirty minutes to complete the first part after you begin.
>
> Look at the question booklet in front of you. Write your name on the front sheet.
>
> Check whether you are male or female.
>
> Give your age as of today.
>
> Give the month, day, and year you were born.

Check to ensure that students are completing this sheet properly.

I am now going to read the directions found on page 1a and 1b of the question booklet. You read them silently and follow along as I read them aloud.

Read the instructions aloud as found on page 1a and 1b of the question booklet. Read through the sample question carefully.

You will have thirty minutes for the first part of this test. You are to answer only questions numbers 1 to 26 in this first session. If you finish early, close your test booklet and wait quietly. Don't look at the other test questions or maps in the booklets. If you have any questions, raise your hand and I will help you.

Now find your place to begin: page 1 in the question booklet and page 1 in the test booklet.

Ready, go.

Circulate among the students to ensure they are marking the answers properly. At the end of the thirty minute period say:

Stop. Close your test question booklet and your map booklet.

Allow approximately a 5 minute rest period before beginning the next session. (The second session may also be given the following day.)

Session Two

Arrange students in the desired seating plan. Distribute map booklets and question booklets if these are not already on the students' desks from session one. Make sure each student has a pencil and a ruler or sheet of paper for measuring. The map booklets and question booklets should remain closed on the students' desks.

Speak slowly and clearly and say:

> We are now ready to begin the second part of the map reading test. Are there any questions about how you should mark your answers to the questions?
>
> You will have <u>forty</u> minutes for the second part of the test. You are to answer questions 27 to 70. If you finish early, close your test booklet and wait quietly. Don't look at the other test questions or maps in the booklet. If you have any questions, raise your hand and I will help you.
>
> Now find your place to begin: page 9 in the question booklet, question 27; pages 6 and 7 in the map booklet.
>
> Ready, go.

Circulate among the students to ensure they are marking the items properly. At the end of the forty minute period say:

> Stop. Close your test question booklet and your map booklet.

Collect the map booklets and the question booklets from the students.

APPENDIX G

Teacher's Manual for Administration of Form II of the Test

TEACHER'S DIRECTIONS

FOR ADMINISTERING

THE GRADE NINE

MAP READING TEST

The Grade Nine Map Reading Test

The Grade Nine Map Reading Test is designed to measure the map reading abilities of beginning grade nine students. Specifically it measures the students' map reading skills in relation to the use and understanding of (a) directions, (b) location, (c) elevation, (d) scale, (e) grid system, and (f) map interpretation.

The testing instrument contains sixty items assessing these six skill areas. Specific skill objectives are outlined. By studying student performance on the items associated with each skill statement, it is possible to identify areas of students' strengths and weaknesses in map reading skills. Thus, the test may be used as a valuable diagnostic instrument recommended for assessing the relative degree of successful skill attainment of beginning grade nine students.

The skill objectives assessed are based on the geography tests as stipulated by the Department of Education in the Program of Studies for the Province of Newfoundland and Labrador for grades four to eight. the development of the geography texts, as well as on the Department of Education curriculum guides: The Master Guide for Social Studies, K-XII in Newfoundland and Labrador;[1] Design for Social Studies, K-VI in Newfoundland and Labrador;[2] Map and Globe Skills, K-7.[3] Consideration was also given to a thorough review of literature and research pertinent to the selected map reading skills.

Scheduling the Test

It is important that students be given an opportunity to try most, if not all, of the items on the test. For this reason the map reading test should be administered in two forty-minute sessions. The first session will involve the student in completing the student data sheet and the first twenty-eight items on the map reading test. The second session will give the students an opportunity to complete test items 29 to 60. It is therefore very important that students close their test question booklets and map booklets after completing item 28 in the first session.

In an ideal situation session one should be followed by session two. A rest period of five minutes should be

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[1]Division of Curriculum, The Master Guide for Social Studies, K-XII in Newfoundland and Labrador (St. John's, Nfld.: Department of Education, n.d.).

[2]Division of Curriculum, Design for Social Studies, K-VI in Newfoundland and Labrador (St. John's, Nfld.: Department of Education, n.d.).

[3]Division of Curriculum, Map and Globe Skills, K-7 (St. John's, Nfld.: Department of Education, n.d.).

provided between the two sessions. If the two sessions cannot follow each other immediately then the first may be given one day and the second session should be administered the following day.

Forty minutes have been designated for session one to allow approximately four minutes for test distribution and completion of the student data sheet and approximately four minutes to read through with the students the directions to the students on page 1a and 1b of the question booklet. Therefore, thirty-two minutes are to be assigned to the students for completion of the first part of the test, items numbering 1 to 28. It is essential that this thirty-two minute allotment be observed during the first testing session.

Forty minutes have been designated for session two. Five minutes are designated for test distribution (if necessary) and for each student to find his place to begin the second part of the test; it starts at item 29. Thirty-five minutes are to be assigned to students to complete the second part of the test items numbering 29 to 60. It is essential that this thirty-five minute time allotment be observed during the second testing session.

Preparing for Test Administration

The examiner should make sure that each student has the following materials during the testing session:

(a) A question booklet

(b) A map booklet

(c) A pencil

(d) A sheet of plain paper or ruler which can be used for measuring distances.

Try to maintain a natural classroom atmosphere. Encourage students to do their best on the tests. However, avoid overemphasizing the importance of the tests because the students might become nervous about them.

Please make sure you are familiar with the directions to the teacher and the directions to the student.

The nature of the students' responses are essential for the further refinement and revision of this test which will be based on a comprehensive statistical analysis. In the actual research report no reference will be made to individual students, teachers, or schools. The personal data obtained will be held in the strictest of confidence. Even though the names of the students will not be revealed, they are required on the test question booklet because it is important that the test serve as an accurate measure of student performance. By requiring a student to write his name on a test, he will be strongly motivated to perform his best. If students' names were not required on the tests, it is felt that the anonymity of student responses could result in a less than best effort by many students. It cannot, therefore, be overemphasized that names will remain anonymous and that confidentiality will be a prime consideration at all times.

If a student makes an error when marking an answer to an item, advise him to erase his answer and circle his new choice. If the first choice cannot be satisfactorily erased, direct the student to place an X through his first choice and then select another.

Administering the Tests

Session One

After the students are seated in the desired arrangement for the testing session, distribute the map reading question booklet and map booklet. Check to ensure that each student has a pencil, and a sheet of paper or ruler for measuring. The map booklets and question booklets should remain closed on the students' desks. Speak slowly and clearly and say:

> We are now going to begin taking the Map Reading Test for Grade Nine students. It is very important that you do your best on this test. The test will show how well you are doing in map reading. It will also show the areas in which you need more help. So make the tests give a good picture of your map reading skills by doing the best you can on each question.

The test will be given in two parts. You will have thirty-two minutes to complete the first part after you begin.

Look at the question booklet in front of you. Write your name on the front sheet.

Check whether you are male or female.

Give your age as of today.

Give the month, day, and year you were born.

Check to ensure that students are completing this sheet properly.

I am now going to read the directions found on page 1a and 1b of the question booklet. You read them silently and follow along as I read them aloud.

Read the instructions aloud as found on page 1a and 1b of the question booklet. Read through the sample question carefully.

You will have thirty-two minutes for the first part of this test. You are to answer only questions numbered 1 to 28 in this first session. If you finish early, close your test booklet and wait quietly. Don't look at the other test questions or maps in the booklets. If you have any questions raise your hand and I will help you.

Now find your place to begin: page 1 in the question booklet and page 1 in the map booklet.

Ready, go.

Circulate among the students to ensure they are marking the answers properly. At the end of the thirty-two minute period say:

Stop. Close your test booklet and your map booklet.

Allow approximately a five minute rest period before beginning the next session. (The second session may also be given the following day.)

Session Two

Arrange students in the desired seating plan. Distribute map booklets and question booklets if these are not already on the students' desks from session one. Make sure each student has a pencil and a ruler or sheet of paper for measuring. The map booklets and question booklets should remain closed on the students' desks.

Speak slowly and clearly and say:

We are now ready to begin the second part of the map reading test. Are there any questions about how you should mark your answers to the questions?

You will have thirty-five minutes for the second part of the test. You are to answer questions 29 to 60. If you finish early, close your test booklet and wait quietly. Don't look at the other test questions or maps in the booklet. If you have any questions, raise your hand and I will help you.

Now find your place to begin: page 11 in the question booklet, question 29 and page 7 in the map booklet.

Ready, go.

Circulate among the students to ensure they are marking the items properly. At the end of the thirty-five minute period say:

Stop. Close your test question booklet and your map booklet.

Collect the map booklets and the question booklets from the students.

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APPENDIX H

Teacher's Manual for Administration and Interpretation of the Grade Nine Map Reading Test

TEACHER'S MANUAL FOR ADMINISTRATION

AND INTERPRETATION OF THE

GRADE NINE MAP

READING TEST

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SECTION ONE

NATURE AND PURPOSES OF THE MAP READING TEST

The Grade Nine Map Reading Test is designed to measure the map reading abilities of beginning grade nine students in the province of Newfoundland and Labrador. Specifically it measures the students' map reading skills in relation to the use and understanding of (a) directions, (b) location, (c) elevation, (d) scale, (e) grid systems, and (f) map interpretation.

It is suggested that this evaluation instrument may serve a number of the following purposes: (a) the gathering of information relative to the performance of individuals and groups in six selected map reading skills, (b) the diagnosis of areas of students' skill strengths and weaknesses, (c) an aid in identifying teaching objectives, (d) a motivational aid to increase interest in and use of map reading skills, and (e) a means of collecting information about the map reading skills of a particular group so that the group's performance may be compared to that of a larger provincial norm group.[1] By using this

[1]R. L. Thorndike and E. Hagen, Measurement and Evaluation in Psychology and Education (3rd ed., New York: John Wiley and Sons, Inc., 1969), pp. 30-33.

test as a diagnostic instrument at the beginning of the school year, a teacher should be able to identify the nature of grade nine students' strengths and weaknesses in map reading skills.

Test Content

The Grade Nine Map Reading Test contains sixty items assessing the six map reading skills previously listed. For each of these skill areas specific statements of map reading skill objectives have been formulated. These twenty-eight objectives assessed by items on the test are outlined in Appendix 1 of this manual.

The skill objectives assessed are based on the geography texts as stipulated by the Department of Education in the Program of Studies for the Province of Newfoundland and Labrador for grades four to eight. The development of the testing instrument was based on the skill content of the geography texts, as well as on the Department of Education curriculum guides: The Master Guide for Social Studies, K-XII in Newfoundland and Labrador;[2]

[2] Division of Curriculum, The Master Guide for Social Studies, K-XII in Newfoundland and Labrador (St. John's, Nfld.: Department of Education, n.d.).

Design for Social Studies, K-VI in Newfoundland and Labrador;[3] Map and Globe Skills, K-7.[4] Consideration was also given to a thorough review of literature and research pertinent to the selected map reading skills.

SECTION TWO

DIRECTIONS FOR ADMINISTERING AND SCORING THE TEST

Scheduling the Test

It is important that students be given an opportunity to try most, if not all, of the items on the test. For this reason the map reading tests should be administered in two forty-minute sessions. The first session will involve the student in completing the student data sheet and the first twenty-eight items in the map reading test. The second session will give the students an opportunity to complete test items 29 to 60. It is therefore very important that students close their test question booklets and map booklets

[3] Division of Curriculum, Design for Social Studies, K-VI in Newfoundland and Labrador (St. John's, Nfld.: Department of Education, n.d.).

[4] Division of Curriculum, Map and Globe Skils, K-7 (St. John's, Nfld.: Department of Education, n.d.).

after completing item 28 in the first session.

In an ideal situation session one should be followed by session two. A rest period of five minutes should be provided between the two sessions. If the two sessions cannot follow each other immediately then the first may be given one day and the second session should be administered the following day.

Forty minutes have been designated for session one to allow approximately four minutes for test distribution and completion of the student data sheet and approximately four minutes to read through with them the directions to the students on page 1a and 1b of the question booklet. Therefore, thirty-two minutes are to be assigned to the students for completion of the first part of the test, items numbered 1 to 28. It is essential that this thirty-two minute allotment be observed during the first testing session.

Forty minutes have been designated for session two. Five minutes are designated for test distribution (if necessary) and for each student to find his place to begin the second part of the test; it starts on item 29. Thirty-five minutes are to be assigned to students to complete the second part of the test, items numbered 29 to 60. It is essential that this thirty-five minute time allotment be observed during the second testing session.

It is important that you follow the procedures outlined in this manual. The scores obtained by students in your class will only be comparable to the norms if the tests are administered ~~in your~~ class in the same manner as in the classes which provided the data for the establishment of the norms.

Preparing for Test Administration

The examiner should make sure that each student has the following materials during a testing session.

(a) A question booklet

(b) A map booklet

(c) A pencil

(d) A sheet of plain paper or ruler which can be used for measuring distances.

Try to maintain a natural classroom atmosphere. Encourage students to do their best on the tests. However, avoid overemphasizing the importance of the tests because the student might become nervous about them.

Please make sure you are familiar with the directions to the teacher and the directions to the student.

If a student makes an error when marking an answer to a test item, advise him to erase his answer and circle his new choice. If the first choice cannot be satisfactorily erased, direct the student to place an X through his first choice and then select another answer.

Administering the Tests

Session One

After the students are seated in the desired arrangement for the testing session, distribute the map reading question booklet and map booklet. Check to ensure that each student has a pencil, and a sheet of paper or ruler for measuring. The map booklets and question booklets should remain closed on the students' desks. Speak slowly and clearly and say:

> We are now going to begin taking the Map Reading Test for Grade Nine students. It is very important that you do your best on this test. The test will show how well you are doing in map reading. It will also show the areas in which you need more help. So make the tests give a good picture of your map reading skills by doing the best you can on each question. The test will be given in two parts. You will have thirty-two minutes to complete the first part after you begin. Look at the question booklet in front of you. Write your name on the front sheet. Check whether you are male or female. Give your age as of today. Give the month, day, and year you were born.

Check to ensure that students are completing this sheet properly.

> I am now going to read the directions found on pages 1a and 1b of the question booklet. You read them silently and follow along as I read them aloud.

Read the instructions aloud as found on pages 1a and 1b of the question booklet. Read through the sample question carefully.

> You will have thirty-two minutes for the first part of the test. You are to answer only questions numbered 1 to 28 in this first session. If you finish early, close your test booklet and wait quietly. Don't look at the other test questions or maps in the booklets. If you have any questions, raise your hand and I will help you. Now find your place to begin: page 1 in the question booklet and page 1 in the map booklet. Ready, go.

Circulate among the students to ensure they are marking the answers properly. At the end of the thirty-two minute period say:

> Stop. Close your test booklet and your map booklet.

Allow approximately a five minute rest period before beginning the next session. (The second session may also be given the following day.)

Session Two

Arrange students in the desired seating plan. Distribute map booklets and question booklets if these are not already on the students' desks from session one. Make sure each student has a pencil and a ruler or sheet of paper for measuring. The map booklets and question booklets should remain closed on the students' desks.

Speak slowly and clearly and say:

> We are now ready to begin the second part of the map reading test. Are there any questions about how you should mark your answers to the questions? You will have thirty-five minutes for the second part of the test. You are to answer questions 29 to 60. If you finish early, close your test booklet and wait quietly. Don't look at the other test questions or maps in the booklet. If you have any questions, raise your hand and I will help you. Now find your place to begin; page 11 in the question booklet, question 29, and page 7 in the map booklet. Ready, go.

Circulate among the students to ensure they are marking the items properly. At the end of the thirty-five minute period say:

> Stop. Close your test question booklet and your map booklet.

Collect the map booklets and the question booklets from the students.

Scoring the Tests

The use of multiple choice questions makes the scoring of the test highly objective. Each correct response receives a score of 1 point. The maximum raw score a student may receive on the test is 60. The teacher may refer to the answer key in Appendix 2 to assist him in scoring the tests.

SECTION THREE

INTERPRETATION OF TEST SCORES

Introduction

The score obtained by a student on the map reading test can reveal much information if the score is interpreted with care. The purpose of this section of the manual is to explain how teachers might approach the interpretation of scores obtained on the map reading test.

Descriptive Statistics

A student's raw score on the map reading test may be obtained by totaling the number of questions answered correctly on the test or any subtest of it. The norm group to whom this test was administered scored from a low of 15 items correct to a high of 59 for a range of 44. The mode or most frequently occurring score was 46. The middle score, called the median, was 41. The average or mean raw score for the norm group was 40.

The raw scores were transformed into percentage scores, so that an indication could be gained about the percentage of items scored correctly on the test as a whole and on each of the subtests. Table 1 presents these data together with information on the obtained standard deviations and standard errors.

The standard deviation is a measure of the degree to which scores are closely bunched around a mean or widely scattered about the mean; the larger the standard deviation, the more widely scattered the score. In a normal distribution, 68 percent of the scores may be expected to fall within plus or minus one standard deviation of the mean; 95 percent would be expected to occur within plus or minus two standard deviation.[5]

The standard error of measurement is used to estimate a student's true score based on the score actually obtained by a student on a test. A teacher may be 95 percent certain that a student's true score on the test lies within the range of the obtained score plus or minus 1.96 times the standard

[5]N. E. Gronlund, Constructing Achievement Tests (Englewood Cliffs, N.J.: Prentice Hall, Inc., 1968), pp. 92-96.

area of measurement.[6] If, for example, a student obtained a score of 42 percent on the test, there is a 95 percent chance that the student's true score falls within the range of approximately 40 to 44 percent; 42 ± 1.96 (1.11).

A summary of the raw and mean percentage scores, standard deviations, and standard errors is presented in Table 1. Not only does the table present the data for the total sample's performance on each subskill, but it also provides information based on a breakdown of the sample into the upper 20 percent, middle 60 percent, and lower 20 percent of the scores. Thus there are several reference points to which a group's performance on the map reading test might be compared to the sample's achievement levels.

[6] F. G. Brown, Principles of Educational and Psychological Testing (New York: Holt, Rinehart, and Winston, 1976), pp. 80-82.

TABLE 1

Summary of Students' Performance on the Sixty Item Test

Skill	Total Possible Raw Score	Mean Raw Score	Standard Deviation (Raw Score)	Mean Per %age Score	Standard Deviation %age Score	Standard Error %age Score
WHOLE TEST	60	39.8	9.9	66.3	16.5	1.11
Upper 20%	60	52.6	2.9	87.7	4.9	
Middle 60%	60	40.3	5.3	67.2	8.9	
Lower 20%	60	25.2	3.8	42.0	6.3	
DIRECTIONS	8	5.4	2.2	67.4	27.6	1.86
Upper 20%	8	7.7	0.8	95.7	10.1	
Middle 60%	8	5.4	2.0	67.3	24.7	
Lower 20%	8	3.1	1.4	39.2	17.2	
SCALE	6	3.4	1.6	56.1	26.7	1.80
Upper 20%	6	4.8	1.1	79.2	18.4	
Middle 60%	6	3.2	1.5	53.9	25.5	
Lower 20%	6	2.4	1.3	39.8	22.2	

TABLE 1 (Continued)

Skill	Total Possible Raw Score	Mean Raw Score	Standard Deviation (Raw Score)	Mean Per %age Score	Standard Deviation %age Score	Standard Error %age Score
ELEVATION	8	5.3	1.9	66.8	23.2	1.56
Upper 20%	8	6.9	1.0	86.1	13.0	
Middle 60%	8	5.6	1.5	69.1	19.1	
Lower 20%	8	3.2	1.5	40.3	18.5	
GRID SYSTEM	12	7.5	2.2	62.1	18.5	1.25
Upper 20%	12	9.7	1.8	81.1	15.2	
Middle 60%	12	7.4	1.8	61.4	14.7	
Lower 20%	12	5.4	1.7	45.3	14.1	
LOCATION	10	7.2	2.2	72.4	21.9	1.48
Upper 20%	10	9.4	0.8	93.6	7.5	
Middle 60%	10	7.4	1.6	74.5	16.4	
Lower 20%	10	4.5	1.8	45.0	18.0	

TABLE 1 (Continued)

Skill	Total Possible Raw Score	Mean Raw Score	Standard Deviation (Raw Score)	Mean Per %age Score	Standard Deviation %age Score	Standard Error %age Score
INTERPRETATION	16	11.0	3.2	68.5	20.3	1.37
Upper 20%	16	14.3	1.3	89.1	8.1	
Middle 60%	16	11.3	2.1	70.9	13.4	
Lower 20%	16	6.5	2.5	40.8	15.8	

Standard Scores

Raw scores are limited, however, because they are not comparable from one test to another due to differences in the lengths or the difficulty levels of the tests. Derived scores, however, can be formulated using raw scores and are comparable across tests. Thus the derived or standard scores allow direct comparison of scores on two or more different tests.

Table 2 presents T scores derived from the raw scores. The T score system is a normalized standard score system, wherein the T scores are area transformed standard scores. The major advantage of this system is that it allows for direct comparisons of scores on two or more tests. Even though a student may obtain different raw scores on two tests, the conversion of the raw scores to T scores may result in a student's falling in the same relative position on both tests. T scores are computed by determining the percent of students scoring below each raw score; these percentages are next converted to normal deviates (z scores) by referring to tables of the normal curve.[7] The obtained z scores are then used to calculate

[7] H. Gulliksen, Theory of Mental Tests (New York: John Wiley and Sons, Inc., 1950), pp. 280-282.

T scores by using the formula $T=50 + 10(z)$.[8]

Percentile Ranks

Another widely used method of expressing raw scores obtained on a test is to convert the raw scores to percentile ranks. The percentile rank of a score is the percent of pupils whose performance falls below that score.[9] Table 2 presents the percentile ranks of scores obtained by the norm group. From the table the reader may note that a raw score of 52 corresponds to the 90th percentile rank; this means that 90 percent of the students scored lower than 52 and that 10 percent scored as high or higher. It is possible to develop percentile ranks corresponding to raw scores obtained by a student on several different tests and thus obtain an indication of the student's relative position or ranking in terms of percentage.

[8] F. G. Brown, Principles of Educational and Psychological Testing (New York: Holt, Rinehart and Winston, 1976), p. 185.

[9] J. Roscoe, Fundamental Research Statistics for the Behavioral Sciences (New York: Holt, Rinehart and Winston, 1969), pp. 17-21.

Table 2

Raw Scores, Percentile Ranks, and T Scores

Raw Score	Percentile Rank	T Score
15	0.2	21.2
16	0.7	25.4
18	1	26.7
19	1.6	28.6
20	2	29.5
21	2.7	30.7
22	3	31.2
23	4	32.5
24	7	35.2
25	9	36.6
26	10	37.2
27	12	38.3
28	15	39.6
29	17	40.5
30	19	41.2
31	22	42.3
32	25	43.3
33	27	43.9
34	29	44.5
35	31	45.2
36	36	46.8
37	40	47.5
38	43	48.2
39	46	49.0
40	48	49.5
41	51	50.3
42	53	50.8
43	56	51.5
44	60	52.5
45	64	53.6
46	69	55.0
47	74	56.4
48	79	58.1
49	82	59.2
50	84	59.9
51	89	62.3
52	90	62.8
53	92	64.0
54	93	64.8
55	96	67.5
56	97	68.8
57	98	70.5
58	99	73.3

Diagnosing Specific Performance Characteristics

In order to identify the particular aspects of map reading skills on which the performance of a class of students was weak or strong a closer analysis of the subtests within the overall test would be required. Appendix 3 of this manual contains an abbreviated list of the map reading skill objectives tested and a list of the items related to each particular skill. In the column headed "Nfld. Norm" is contained the percentage of beginning grade nine students in the Newfoundland norming group who got each item correct. In the column headed "Class Norm" a teacher may enter the percentage of students in his class who got each item correct at the beginning of grade nine. Two approaches may then be used by a teacher to analyze these data.

Using the first approach a teacher may compare the performance of his students with the average performance of students in the norm group. This may be done at the class, school, or board level. Close observance of values entered in the columns may suggest areas in which the performance of a class is below, at parity with, or above the performance of the provincial norm group.

The percentage correct values may also be examined from the point of view of student performance in comparison to some "subjective standard" students may be expected to achieve in specific skill areas at the beginning of grade nine. This second approach would require a teacher to decide, for each item in the test, what percent of the students at the beginning of grade nine should reasonably be expected to answer the item correctly. This could serve as a subjective standard against which the performance of the students may be compared. This could also be done for each of the subtests.

A word of caution is necessary at this point. A teacher should realize that being above or below a particular norm is not in itself good or bad. There will probably be a variety of items or subtests upon which students may be above or below the tentative norms. The main value of the norm is, of course, to make it possible to determine the largest or most notable discrepancies between class performance and the estimated norm. In the final analysis it is, in most cases, the classroom teacher who will decide the implications of his class's performance on the map reading test.

SECTION FOUR

TEST CHARACTERISTICS

Item Tryout and Selection

The Grade Nine Map Reading Test is designed to measure the ability of beginning grade nine students to use and understand the following map reading skills: (a) directions, (b) location, (c) elevation, (d) scale, (e) grid systems, and (f) map interpretation.

The sixty items included in the present form of the test were selected from seventy items tried out in June of 1983 on two classes of grade eight students in the Roman Catholic School Board for Conception Bay North. Forty-nine students completed the tests. The results of the initial tryout were used to establish item difficulty and item discrimination indices for each item. The effectiveness of the distractors in each item was also studied. Based on the item analysis, sixty items were selected for inclusion in the final form of the test which was used for gathering normative data.

Norms Sample

The derivation of test norms was based on the results obtained from a sample of grade nine geography classes in

Newfoundland. Ten schools containing grade nine classes were randomly selected from among all the schools containing grade nine students in the Province of Newfoundland and Labrador. Within these schools a random selection of ten grade nine geography classes was chosen. Table 3 outlines the characteristics of the sample.

There was one grade nine class selected in each of the school boards listed with the exception of the Avalon Consolidated School Board in which one class in two different schools participated. An examination of Figures 1 and 2 gives an indication of the various geographic regions of the province from which the sample was drawn. The shaded districts were the ones which had students participate in the study.

Derivation of Norms

The test was completed by two hundred twenty students. Nine classes completed the tests between October third and fourteenth. The tenth class completed the tests, during the period of October nineteenth to the twenty-first, 1983. The students' tests were scored by the test developer and then the data were analyzed by using the Statistical Package for the Social Sciences[10] computer program. As a result the

[10] N. H. Nie, Statistical Package for the Social Sciences (New York: McGraw-Hill, Inc., 1975).

T scores, percentile ranks, and item norm percentages were derived from the raw scores.

Table 3

Characteristics of the Study Sample

Map No.	Board	Sample Size	Sex M	Sex F	Age In Years 13	14	15	16	17
	(Integrated)								
101	Vinland	14	4	10	2	6	4	1	1
103	Deer Lake	28	8	20	4	24			
107	Terra Nova	29	19	10	3	17	5	4	
111	Avalon Consolidated	*48	21	26	11	24	8	2	3
115	Bay of Islands - St. Georges	20	12	8	1	15	4		
126	Burgeo	25	13	12	4	20		1	
	(Roman Catholic)								
506	Exploits - White Bay	16	11	5	1	12	3		
511	Placentia - St. Mary's	25	13	12	1	14	4	4	2
514	St. John's	15	15	0	1	12		2	
	Total	*220	116	103	28	144	28	14	6

*The discrepancies in the totals are due to the inability to determine the sex of one of the students in the sample.

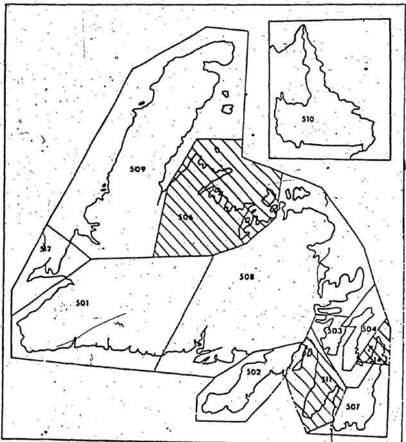

Figure 1

Roman Catholic School Districts

Source: Division of School Services, Directory of Newfoundland and Labrador Schools (St. John's, Nfld.: Department of Education, 1982), p. 44.

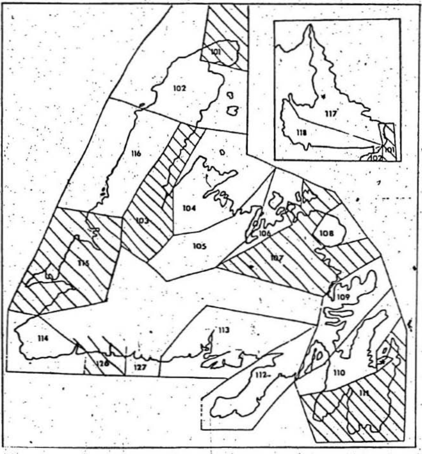

Figure 2

Integrated School Districts

Source: Division of School Services, Directory of Newfoundland and Labrador Schools (St. John's, Nfld.: Department of Education, 1982), p. xvii.

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Test Reliability

A Kuder-Richardson 20 reliability coefficient of .89 was produced on the overall test. The test may be viewed, then, as a relatively highly reliable instrument for measuring the map reading abilities of beginning grade nine students.

Test Validity

Although several types of validity may be defined, for the purposes of this test, content validity is of special importance. Content validity refers to the extent to which the content of the test is a representative sample of the skills that are the goals of instruction in the schools of the Province of Newfoundland and Labrador. In the construction of the map reading test reference was made to (a) the textbooks in use in Newfoundland schools in social studies programs from grades four to eight, (b) recent courses of study, such as The Master Guide for Social Studies, K-XII in Newfoundland and Labrador[11] and Design for Social Studies, K-VI in Newfoundland and Labrador,[12]

[11]Division of Curriculum, The Master Guide for Social Studies, K-XII in Newfoundland and Labrador (St. John's, Nfld.: Department of Education, n.d.).

[12]Division of Curriculum, Design for Social Studies, K-VI in Newfoundland and Labrador (St. John's, Nfld.: Department of Education, n.d.).

(c) a special Department of Education report entitled Map and Globe Skills, K-7[13] as well as (d) a thorough review of research and literature related to map reading skills.

The instrument developed was also submitted to five individuals who made suggestions for revisions in the test. Two of these were teachers of grade eight geography having at least three years experience teaching the geography program at the grade eight level. Two instructors from Memorial University of Newfoundland examined the test as well. One of these was in the Social Studies division of the Faculty of Education and the other was an instructor in cartography in the Geography Department, Faculty of Arts. The test was also examined by a testing expert with the American Guidance Service at Circle Pines, Minnesota. Several suggestions from these individuals regarding test revisions were implemented.

[13] Division of Curriculum, Map and Globe Skills, K-7 (St. John's, Nfld.: Department of Education, n.d.).

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APPENDIX 1

Map Reading Test Objectives

1. The ability to understand and use directions.

a. Given a sketch map of a region without a direction finder to accompany it, the student will correctly identify the top of the map as the part representing the direction North.

b. Given a map, a direction finder, and the position of a point on the map, the student will correctly identify a point located in any of the four cardinal directions from the given position of the original point.

c. Given a map, a direction finder, and the position of a point on the map, the student will correctly identify a point located in any of the four intermediate directions from the given position of the original point.

d. Given a map, a direction finder, and the position of any two points, the student will correctly identify the cardinal direction which would have to be travelled in order to go from one point to the other.

e. Given a map, a direction finder, and the position of any two points on the map, the student will correctly identify the intermediate direction which would have to be travelled in order to go from one point to the other.

2. The ability to understand and use scale.

a. Given a map with a linear scale showing kilometres, the student will choose the answer which best indicates the linear distance between any two points on the map.

b. Given a map with a linear scale showing kilometres, the student will follow a defined path and compute the distance covered and then choose the answer which best indicates the distance covered.

c. Given three sketch maps of different areas and of different scales, the student will compare the maps and choose the statement that best expresses the relationship between the different areas shown on the maps.

3. The ability to understand and use elevation.

a. Given a map showing different elevation levels by means of shading, the student will choose the correct elevation of a given point.

b. Given a map showing different elevation levels by means of shading, the student will choose the correct point for a given elevation.

c. Given a map showing different elevation levels by means of shading, the student will choose the statement which best describes the relationship between the elevation of the land the the courses followed by the rivers on the map.

d. Given a cross sectional profile of an area, the student will choose the cross section of the area which presents the best visualization of the area shown on the relief map.

4. The ability to understand and use a grid system.

a. Given an alphabetical-numerical grid system on a map, and the alphabetical-numerical data describing the position of a place, the student will choose the place described.

b. Given an alphabetical-numerical grid system on a map, the student will choose the correct method for expressing the position of an identified place.

c. Given a map containing lines of latitude, the student will choose the correct method for describing the location of a point on a map in terms of its latitude.

d. Given a map containing lines of longitude, the student will choose the correct method for describing the location of a point on a map in terms of its longitude.

e. Given a map with lines of latitude and longitude marked in degrees, the student will choose the statement that indicates that all points along an indicated line all share the same latitude.

f. Given a map with lines of latitude and longitude marked in degrees, the student will choose the statement that indicates that all points along an indicated line all share the same longitude.

g. Given a map with lines of latitude and longitude marked in degrees, the student will choose the place which names the correct location of a point when the latitude and longitude coordinates for that point are provided.

h. Given a map with lines of latitude and longitude marked in degrees, the student will choose the correct method to be used to name the latitude and longitude of a designated place.

5. The ability to understand and use location.

a. Given a map, the student will be able to locate a specific point by using one or more of the standard semi-pictorial map symbols, such as rivers, lakes, coastlines, roads, mountains, cities, and islands.

b. Given a map, the student will be able to locate a specific point by using the symbols found in the map's legend.

c. Given a map, the student will be able to locate a specific point by using one or more of the unlabelled standard lines of latitude and longitude.

d. Given a map, the student will be able to locate a specific point by using direction and/or distance in order to follow a route of travel.

6. The ability to interpret maps.

a. Given a map, the student will infer from the information on the map man's activities at various locations, and will choose the most appropriate statement that relates the location of a specific place to a specific activity.

b. Given a map containing climatic information, and a description of the climate of a particular area, the student will choose the area that is described.

c. Given a map the student will select from the data shown the information necessary to choose the correct conclusion concerning the relationship between data on the map.

d. Given two or more maps of the same area, the student will combine the data shown, and will choose the correct conclusion to be drawn concerning the relationship between data on the maps.

APPENDIX 2

Map Reading Test Answer Key

Item	Answer	Item	Answer	Item	Answer
1	a	21	d	41	a
2	d	22	b	42	c
3	a	23	d	43	c
4	b	24	a	44	b
5	c	25	c	45	a
6	c	26	b	46	d
7	c	27	d	47	c
8	a	28	b	48	d
9	b	29	b	49	a
10	c	30	c	50	c
11	c	31	b	51	a
12	b	32	b	52	b
13	c	33	a	53	a
14	b	34	d	54	c
15	a	35	a	55	d
16	a	36	b	56	c
17	c	37	d	57	c
18	c	38	a	58	d
19	c	39	a	59	b
20	d	40	b	60	c

APPENDIX 3

Norm Group Responses to Test Items Corresponding to Skill Objectives

Skill	Item No.	Nfld Norm	Class Norm
1. Directions			
(a) Top of map represents North.	1	95	
(b) Uses cardinal directions to identify a point.	18	72	
	37	59	
(c) Uses intermediate directions to identify a point.	19	58	
(d) Travels in cardinal direction.	23	76	
(e) Travels in intermediate direction.	24	74	
	50	58	
2. Scale			
(a) Computes linear distance between two points.	9	76	
	39	66	
(b) Follows path and computes distance.	4	52	
(c) Compares distances on maps of different scales.	40	41	
	7	47	
	8	55	
3. Elevation			
(a) Identifies elevation of a point.	14	75	
	41	77	
(b) Identifies point for elevation level.	13	81	

Skill	Item No.	Nfld Norm	Class Norm
(c) Relates river course to elevation.	42	81	
(d) Uses cross sectional profile.	16	61	
	51	67	
	17	32	
	52	62	
4. Grid System			
(a) Uses alphabetical-numerical system to find position of a place.	30	91	
(b) Uses alphabetical-numerical system to describe position of a place.	29	90	
(c) Uses lines of latitude.	5	55	
(d) Uses lines of longitude.	43	61	
(e) All points along lines of latitude share common latitude.	20	20	
	44	30	
(f) All points along lines of longitude share common longitude.	21	58	
	22	63	
(g) Uses co-ordinates to find position of a place.	25	83	
	53	75	
(h) Uses co-ordinates to describe position of a place.	26	52	
	54	68	

Skill	Item No.	Nfld Norm	Class Norm
5. Location			
Locates places by using:			
(a) semi-pictorial map symbols;	45	69	
	46	88	
(b) a map legend;	10	86	
	27	70	
	55	71	
(c) unlabelled standard lines of latitude and longitude.	11	78	
	28	69	
	56	56	
(d) direction and/or distance to follow a route of travel.	2	74	
	3	65	
6. Interpretation			
(a) Relates location of a place to a specific activity.	48	81	
	57	71	
	58	68	
(b) Identifies climatic area	6	54	
(c) Draws conclusions about relationship of data on a map.	31	73	
	34	65	
	12	86	
	49	53	
	59	50	

Skill	Item No.	Nfld Norm	Class Norm
(d) Draws conclusions about relationship of data on two or more maps.	15	83	
	32	56	
	33	82	
	35	48	
	36	67	
	47	74	
	60	83	

APPENDIX I

Distractor Effectiveness of Form I Items' Alternatives Selected for Revisions

Item	Alternative	Upper Group	Lower Group
9	*A	11	8
	B	0	0
	C	1	1
	D	1	3
12	A	0	1
	B	0	4
	C	0	3
	*D	13	4
16	A	2	3
	B	1	0
	*C	9	5
	D	0	1
17	A	0	4
	B	0	0
	*C	12	6
	D	1	1
21	A	1	7
	*B	10	3
	C	2	0
	D	0	0
27	A	0	1
	*B	13	6
	C	0	0
	D	0	5
28	A	0	0
	B	0	2
	*C	12	7
	D	1	3
54	*A	13	7
	B	0	1
	C	0	4
	D	0	0

Item	Alternative	Upper Group	Lower Group
56	*A	0	5
	B	0	1
	C	13	6
	D	0	0
57	A	0	2
	B	0	1
	C	0	1
	*D	13	6
63	*A	11	1
	B	1	7
	C	0	2
	D	0	0
65	A	0	1
	B	2	1
	C	0	0
	*D	10	7
67	A	0	1
	B	1	3
	*C	11	4
	D	0	0
70	A	0	0
	B	0	3
	*C	12	4
	D	0	1

*Indicates correct answer.

APPENDIX J

Item Correspondence on Form I and Form II Tests

Initial	Revised	Initial	Revised
1	7	36	21
2	8	37	22
3	---	38	23
4	3	39	24
5	4	40	25
6	5	41	26
7	6	42	27
8	---	43	---
9	1	44	28
10	---	45	37
11	---	46	38
12	2	47	39
13	9	48	40
14	---	49	41
15	---	50	42
16	10	51	43
17	11	52	44
18	---	53	---
19	29	54	45
20	30	55	46
21	31	56	47
22	32	57	48
23	33	58	49
24	34	59	---
25	35	60	50
26	36	61	51
27	12	62	52
28	13	63	53
29	14	64	54
30	15	65	55
31	16	66	56
32	17	67	57
33	18	68	58
34	19	69	59
35	20	70	60

APPENDIX K

Test Items According to Skill, Form I

Test Items According to Skill

Skill Area	Objective	Test Items	Total
Directions	1a	9	1
	1b	33, 45	2
	1c	34, 46	2
	1d	38, 59	2
	1e	39, 60	2
Scale	2a	3, 10, 13, 47	4
	2b	5, 48	2
	2c	1, 2	2
Elevation	3a	29, 49	2
	3b	28, 50	2
	3c	31, 61	2
	3d	32, 62	2
Grid System	4a	15, 20	2
	4b	14, 19	2
	4c	26, 51	2
	4d	35, 52	2
	4e	36	1
	4f	37	1
	4g	40, 63	2
	4h	41, 64	2
Location	5a	53, 54, 55	3
	5b	16, 42, 43, 65	4
	5c	17, 44, 66	3
	5d	4, 12	2
Interpretation	6a	11, 18, 57, 67, 68	5
	6b	7, 8	2
	6c	21, 24, 27, 58, 69	5
	6d	22, 23, 25, 26, 30 56, 70	7
			70

APPENDIX L

Test Items According to Skill, Form II

Skill Area	Objective	Test Items	Total
Directions	1a	1	1
	1b	18, 37	2
	1c	19, 38	2
	1d	23	1
	1e	24, 50	2
Scale	2a	9, 39	2
	2b	4, 40	2
	2c	7, 8	2
Elevation	3a	14, 41	2
	3b	13, 42	2
	3c	16, 51	2
	3d	17, 52	2
Grid System	4a	30	1
	4b	29	1
	4c	5, 43	2
	4d	20, 44	2
	4e	21	1
	4f	22	1
	4g	25, 53	2
	4h	26, 54	2
Location	5a	45, 46	2
	5b	10, 27, 55	3
	5c	11, 28, 56	3
	5d	2, 3	2
Interpretation	6a	48, 57, 58	3
	6b	6	1
	6c	31, 34, 12, 49, 59	5
	6d	32, 33, 35, 36, 15, 47, 60	7
			60

APPENDIX M

Correspondence Relative to Sample Participation

Cupids, C.B.
Newfoundland
A0A 2B0
April 12, 1983

(Name and address of school
board superintendent)

Dear ____________________

I am conducting thesis research as part of a Master of Education degree at Memorial University. My study deals with grade eight students' map reading abilities and I would welcome your co-operation.

I have constructed a map reading test and I am about to carry out the preliminary tryout stage of the test on two classes of geography students.

The second stage involves choosing a sample of classes from nine school boards across the Province of Newfoundland and Labrador from whom to obtain test data for statistical analysis in this study. Your board is one of the nine that has been selected and I therefore seek permission to use students and teachers of grade eight geography in your board in June of 1983. The name of the students and schools used in the study shall remain anonymous.

There will be full instructions for the teachers to administer the tests to the students, and the total time taken will probably be little more than an hour. The only apparatus the school needs to provide is to ensure that each student has a pencil and a sheet of plain paper.

I would be most pleased, because of time limitations, if you would let me know by return mail, as soon as possible, whether the students in your board will participate.

Your help will be very much appreciated because any success the test used in this study may have will depend to a considerable extent upon the co-operation of the school districts chosen.

Sincerely yours,

____
Peter T. Laracy
(709)-528-4875
528-4651

Cupids, Conception Bay
Newfoundland A0A 2B0
May 30, 1983

(Name and address of school
board superintendent)

Dear ______________________

In a letter dated April 12, 1983 I contacted you seeking your co-operation in a matter of some significance for geographic education in this province. In my original letter I attempted to explain the nature of my research. Please permit me to elaborate a little further on my research plans, how they have changed and how you may be of invaluable service to myself and also to the geography curriculum, students, and teachers of this province.

As part of my thesis research towards a Master of Education degree I am studying the map reading abilities of junior high school students. It is my goal to develop and standardize a map reading test for junior high school students in Newfoundland. Over the course of the past year I have developed a test with test items pertaining to eighteen maps.

My original plan was to select a province-wide random sample of students from whom to obtain normative data and to have this sample complete the test in June of 1983. However, the recent labour dispute which closed most schools in this province for three weeks has caused me to change my testing schedule. I feel that participation in this research study at this time would be an unfair imposition on the students and teaching staff who were selected for participation in this study.

An equally valid collection of statistical data could be obtained by using grade nine students at the beginning of the 1983-1984 school year. It is with this in mind that I must again seek your kind understanding and ask for your co-operation in permitting me to use one class of grade nine geography students in (name of school and community) in my study.

Continued...../2

..../2

If you agree to participate and if it would not be too much of an imposition, at this time, I would be most grateful if you could provide me with the name and phone number of the principal in each school concerned so that arrangements for the testing session in the autumn could be planned.

The map reading test I have developed will be administered to a random sample of approximately 250 students from all parts of the province early in the 1983-1984 school year.

The privilege of being selected to participate in the setting of a milestone in geographic education in this province will surely be a great honour to your school board, teaching staff and students. Indeed, I'm sure it will also serve as a valuable geographic learning experience for those directly involved.

The names of the students and schools participating would remain anonymous and would be held in strictest confidence. Only the name of the school board would be mentioned in my thesis.

The assistance which you, your staff and the students of your board can render in this important task will be deeply appreciated by this researcher. I look forward to your prompt response, confident that you will understand my situation and that together we can make a fruitful attempt to further geographic education in this province.

Sincerely yours,

Peter T. Laracy

Cupids, Conception Bay
Newfoundland AOA 2B0
July 28, 1983

(Address of principal
of school selected)

Dear ________________

I contacted the superintendent of your school board in June of 1983 requesting and receiving permission to use students in this school board to participate in a research study. As part of my thesis research towards a Master of Education degree I am studying the map reading abilities of junion high school students.

The focus of my research is the development and standardization of a map reading test for junior high school students in Newfoundland. The test has been developed, statistically analyzed, and revised on a small sample of students. The development of norms for the test will be based on an administration of the test to approximately 250 students from various parts of the province at the beginning of the 1983-1984 school year. Your school has the distinction of being one of those in which a grade nine geography class has been chosen to participate in this study. If you will have only one grade nine geography calss that class will be the one to participate in the study. If there will be more than one grade nine geography class I would greatly appreciate your providing me with an indication of the numbers of classes and the manner in which the classes will be identified, e.g., by room number, by teacher's name, by alphabetical letter, etc.

When you return this information to me, I shall statistically select one of the grade nine geography classes to participate in the study. I shall then notify you of the class selected and I shall forward the tests to you along with a full set of instructions for the teacher to administer the test to the students.

The only material the school would need to provide is to ensure that each student has a pencil, and a sheet of plain

Continued...../2

..../2

paper or a ruler. For the purposes of this study, the names of the students and schools participating would remain anonymous and would be held in strictest confidence by this researcher. Only the name of the school board would be mentioned in my thesis.

All that I have written in this letter up to this point is predicated on the assumption that you will concur with your superintendent and grant me the essential co-operation I need to successfully conclude my research.

The assistance which the students and staff of your school can render in this most important task will be deeply appreciated. Any success the map reading test developed and used in this study may have will depend to a considerable extent upon the co-operation you can grant me at this data collection stage of my research. I look forward to your prompt response, confident that you will understand my needs and that together we can make a fruitful attempt to further geographic education in this province.

Sincerely yours,

Peter T. Laracy

Cupids, Conception Bay
Newfoundland A0A 2B0
September 13, 1983

(Name and address of
school principal)

Dear ______________

Thank you for your response to my earlier request for information pertaining to your grade nine geography students. Grade nine Class ____ has been selected to participate in the research study.

Could you please pass along the enclosed letter of explanation and map reading tests to the appropriate teacher? May I take this opportunity to express my most sincere thanks for your kind consideration and generous co-operation in helping to make this research study a success.

Sincerely yours,

____
Peter T. Laracy

Encl.

Cupids, Conception Bay
Newfoundland A0A 2B0
September 13, 1983

(Name and address of
school principal)

Dear ______________

I hope that everything is going well for you, your staff, and students as this new school year begins. Time is certainly a precious commodity at this time during the school year and perhaps you have not yet had an opportunity to respond to my previous letter. In my earlier letter to you before the beginning of the school year, I indicated that I needed to know the number of grade nine geography classes in your school so that I might select one to participate in my thesis research.

Recognizing that the beginning of the school year is an extremely busy period, in lieu of following the procedure outlined in my earlier letter you may opt to follow the procedure described below for selecting one of your grade nine geography classes to participate in the research study.

First, write the name of each grade nine geography class on a separate slip of paper.

Second, place the slips of paper in a bag, mix them up and randomly select one slip of paper. The name of the class appearing on that slip of paper would be the class chosen to participate in the study.

It is extremely important that all classes have an equal chance of being selected. If there is only one grade nine geography class in your school, then that class would be the one to participate in the study. This selection is conditional, of course, upon the permission and co-operation of yourself and the staff member concerned.

When you have carried out the selection procedure and engaged the co-operation of the appropriate teacher, I

Continued..../2

..../2

would be most grateful if you could pass along to the teacher the enclosed letter of explanation and map reading tests.

May I take this opportunity to express my most sincere thanks for your kind consideration and generous co-operation in helping to make this research study a success.

Sincerely yours,

Peter T. Laracy

Encl.

Cupids, Conception Bay
Newfoundland A0A 2B0
September 13, 1983

Dear Teacher:

I have been in contact with your superintendent and principal, who have given their permission for the participation of this school in a research study I am conducting towards the completion of a Master of Education thesis at Memorial University. I should welcome your co-operation as the success of my research depends to a considerable extent upon the participation of those teachers and students who have the distinction of being selected for this study. If it would not be too much of an imposition upon you and your students, I would be deeply grateful if you could administer the enclosed map reading tests to your grade nine geography class anytime during the period from October 3 to October 14.

Permit me to elaborate briefly on the nature of my research. It was my intention to develop and standardize a map reading test for junior high school students. The test has been developed and trial tested using a small sample of students. The present stage of my research involves the collection of data from a random selection of ten grade nine geography classes from across the Province of Newfoundland and Labrador. The data collected will be used to establish norms for the test.

The names of the students, teachers, and schools used in this study would be held in strictest confidence. Only the name of the school board would be mentioned in the thesis report.

Participation in setting a milestone in geographic education in this province is certainly a unique opportunity for yourself and your students. Indeed I'm sure your students would find this to be a valuable geographic learning experience.

Continued..../2

..../2

The assistance which you have the ability to provide in this most important task would serve to further the cause of geographic education in this province and would be greatly appreciated by this fellow colleague.

Full directions are provided in the teachers manual for administering the test. Attached to the manual is an envelope containing instructions and materials for returning the completed tests to this researcher.

I look forward to your prompt response confident that you will understand my situation and that together we can make a beneficial effort towards improving the social studies curriculum in this province.

Sincerely yours,

Peter T. Laracy

(I may be contacted at: 528-4651)
528-4875)
528-4441)

DIRECTIONS FOR RETURN OF COMPLETED TESTS

Teacher:

(1) Please enclose the map booklets and question booklets in an appropriate box.

(2) Wrap the box securely with tape or string.

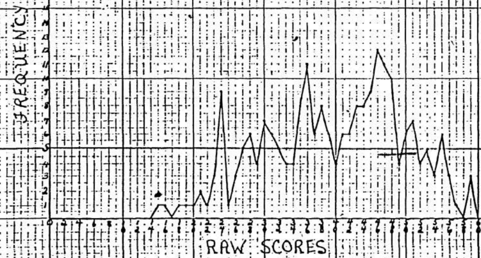
(3) Place the return address label on the outside of the box.

(4) Return the completed test package to this researcher via C.O.D.

Thank you for promptly returning this secure parcel to your post office.

APPENDIX N

FREQUENCY POLYGON



APPENDIX O

Percentage Correct Responses to Test Items Corresponding to Skill Objectives

Skill	Item No.	% Correct	95% Confidence Level
1. Directions			
(a) Top of map represents North.	1	95	91.2-98.8
(b) Uses cardinal directions to	18	72	68.2-75.8
identify a point.	37	59	55.2-62.8
(c) Uses intermediate directions to	19	58	54.2-61.8
identify a point.	38	47	43.2-50.8
(d) Travels in cardinal direction.	23	76	72.2-79.8
(e) Travels in intermediate	24	74	70.2-77.8
direction.	50	58	54.1-61.8
2. Scale			
(a) Computes linear distance between	9	76	72.5-79.5
two points.	39	66	62.5-69.5
(b) Follows path and computes distance.	4	52	48.5-55.5
	40	41	37.5-44.5
(c) Compares distances of maps of	7	47	43.5-50.5
different scales.	8	55	51.5-58.5
3. Elevation			
(a) Identifies elevation.	14	75	71.9-78.1

Skill	Item No.	%Correct	95% Confidence Level
3. Elevation (Cont'd)			
	41	77	73.9-80.1
(b) Identifies point for elevation level.	13	81	77.9-84.1
	42	81	77.9-84.1
(c) Relates river course to elevation.	16	61	57.9-64.1
	51	67	63.9-70.1
(d) Uses cross sectional profile.	17	32	28.9-35.1
	52	62	58.9-65.1
4. Grid System			
(a) Uses alphabetical numerical system.	30	91	88.5-93.5
(b) Uses alphabetical numerical system to describe position of a place.	29	90	87.5-92.5
(c) Uses lines of latitude.	5	55	52.5-57.5
	43	61	58.5-63.5
(d) Uses lines of longitude.	20	20	17.5-22.5
	44	30	27.5-32.5
(e) All points along line of latitude share common latitude.	21	58	55.5-60.5
(f) All points along line of longitude share common longitude.	22	63	60.5-65.5

Skill	Item No.	%Correct	95% Confidence Level
4. Grid Systems (Cont'd)			
(g) Uses co-ordinates to find position of a place.	25	83	80.5-65.5
	53	75	72.5-77.5
(h) Uses co-ordinates to describe position of a place.	26	52	49.5-54.5
	54	68	65.5-70.5
5. Location			
Locates places by using:			
(a) Semi-pictorial map symbols;	45	69	66.1-71.9
	46	88	85.1-90.9
(b) a map legend;	10	86	83.1-88.9
	27	70	67.1-72.9
	55	71	68.1-73.9
(c) unlabelled standard lines of latitude and longitude;	11	78	75.1-80.9
	28	69	66.1-71.9
	56	56	53.1-58.9
(d) direction and/or distance to follow a route of travel.	2	74	71.1-76.9
	3	65	62.1-67.9
6. Interpretation			
(a) Relates location of a place to a specific activity.	48	81	78.3-83.7
	57	71	68.3-73.7
	58	68	65.3-70.7

Skill	Item No.	% Correct	95% Confidence Level
6. Interpretation (Cont'd)			
(b) Identifies climatic area.	6	54	51.3-56.7
(c) Draws conclusions about relationship of data on a map.	31	73	70.3-75.7
	34	65	62.3-67.7
	12	86	83.3-88.7
	49	53	50.3-55.7
	59	50	47.3-52.7
(d) Draws conclusions about relationship of data on two or more maps.	15	83	80.3-85.7
	32	56	53.3-58.7
	33	82	79.3-84.7
	35	48	45.3-50.7
	36	67	64.3-69.7
	47	74	71.3-76.7
	60	83	80.3-85.7

APPENDIX P

Items' p Values, Point Biserial Correlations, and Distractor Effectiveness for the Sixty Item Test

Item No.	p Value	Point Biserial Correlation	Distractor	Low 25%	3rd 25%	2nd 25%	Top 25%
1	.95	.43	*A	48	53	53	55
			B	4	0	0	0
			C	1	1	1	0
			D	2	1	0	0
2	.74	.49	A	3	5	2	0
			B	3	4	3	1
			C	21	6	5	4
			*D	28	40	45	50
3	.65	.60	*A	20	30	42	50
			B	19	19	7	2
			C	6	3	5	1
			D	9	3	1	2
4	.52	.29	A	12	21	12	14
			*B	26	19	31	38
			C	10	9	6	1
			D	7	6	6	2
5	.55	.54	A	8	4	5	2
			B	7	10	3	0
			*C	17	23	32	49
			D	23	18	15	4
6	.54	.21	A	11	4	2	2
			B	16	13	17	13
			*C	22	30	32	34
			D	4	6	3	5
7	.47	.34	A	3	1	0	1
			B	23	28	21	9
			*C	19	19	27	39
			D	10	7	7	6

Item No.	p Value	Point Biserial Correlation		Distractor Effectiveness Low 25%	3rd 25%	2nd 25%	Top 25%
8	.55	.52	*A	19	17	36	48
			B	10	2	3	0
			C	0	5	1	1
			D	26	31	15	6
9	.76	.43	A	12	15	3	3
			*B	35	33	49	50
			C	5	3	2	2
			D	2	4	1	0
10	.86	.56	A	10	5	2	0
			B	3	1	0	0
			*C	37	48	50	55
			D	4	1	0	0
11	.78	.40	A	4	11	0	0
			B	12	40	8	2
			*C	35	3	43	53
			D	2	1	4	0
12	.86	.54	A	5	1	1	0
			*B	37	47	50	55
			C	5	2	1	0
			D	7	4	2	0
13	.81	.55	A	11	8	4	2
			B	3	3	0	1
			*C	33	41	51	52
			D	6	2	0	0
14	.75	.50	A	10	4	5	3
			*B	25	46	46	48
			C	18	4	3	4
			D	1	1	0	0
15	.83	.57	*A	32	47	53	51
			B	4	2	0	0
			C	5	2	0	0
			D	14	4	2	3
16	.61	.39	*A	23	31	36	43
			B	8	9	9	5
			C	17	9	9	5
			D	6	1	1	2

Item No.	p Value	Point Biserial Correlation	Distractor	Effectiveness Low 25%	3rd 25%	2nd 25%	Top 25%
17	.32	.45	A	23	23	21	10
			B	15	14	12	7
			*C	8	12	16	34
			D	9	6	6	3
18	.72	.48	A	22	9	16	4
			B	4	1	0	0
			*C	24	45	39	51
			D	2	0	0	0
19	.58	.56	A	13	6	4	2
			B	15	15	9	4
			*C	15	26	37	49
			D	10	8	5	0
20	.20	.48	A	7	14	5	6
			B	25	22	29	21
			C	15	14	9	6
			*D	5	5	11	22
21	.58	.30	A	9	7	4	0
			B	7	14	11	7
			C	5	3	31	0
			*D	27	27	9	43
22	.63	.32	A	8	5	5	3
			*B	29	29	37	43
			C	8	4	2	0
			D	7	16	10	9
23	.76	.53	A	5	0	2	0
			B	17	10	6	2
			C	2	1	0	0
			*D	26	43	46	53
24	.74	.62	*A	23	41	45	54
			B	21	12	6	1
			C	5	1	3	0
			D	3	1	1	0
25	.83	.55	A	7	10	1	1
			B	5	41	1	0
			*C	36	1	52	54
			D	3	3	0	0

Item No.	p Value	Point Biserial Correlation	Distractor Effectiveness	Low 25%	3rd 25%	2nd 25%	Top 25%
26	.52	.36	A	18	18	16	9
			*B	20	25	28	42
			C	8	9	9	3
			D	2	3	1	1
27	.70	.50	A	3	3	2	0
			B	11	14	8	4
			C	11	1	43	1
			*D	24	37	2	49
28	.69	.55	A	6	3	2	0
			*B	23	37	41	51
			C	5	2	1	0
			D	16	12	9	3
29	.90	.06	A	0	0	1	0
			*B	49	49	49	50
			C	5	4	4	5
			D	0	0	1	0
30	.91	.20	A	5	5	0	2
			B	1	2	0	1
			*C	48	48	54	50
			D	1	0	1	2
31	.73	.60	A	14	2	1	1
			*B	23	40	47	51
			C	13	10	5	3
			D	5	3	1	0
32	.56	.56	A	16	7	8	1
			*B	14	26	35	47
			C	18	16	10	6
			D	7	6	2	0
33	.82	.73	*A	26	49	53	53
			B	14	5	0	0
			C	3	1	1	2
			D	5	0	1	0
34	.65	.47	A	8	7	4	1
			B	8	7	2	0
			C	11	9	9	5
			*D	23	32	39	48

Item No.	p Value	Point Biserial Correlation		Distractor Effectiveness Low 25%	3rd 25%	2nd 25%	Top 25%
35	.48	.49	*A	13	19	34	40
			B	10	11	7	5
			C	14	10	7	7
			D	12	11	5	2
36	.67	.59	A	16	7	3	2
			*B	19	34	47	47
			C	10	8	5	3
			D	6	6	0	2
37	.59	.63	A	3	1	0	0
			B	30	24	14	8
			C	6	2	41	0
			*D	14	28	0	47
38	.47	.71	*A	8	14	32	49
			B	13	13	4	2
			C	14	9	7	0
			D	18	19	12	4
39	.66	.46	*A	24	37	37	47
			B	14	9	7	6
			C	8	5	3	1
			D	4	1	1	0
40	.41	.34	A	9	11	15	7
			*B	13	23	21	34
			C	20	10	13	10
			D	12	10	5	4
41	.77	.59	*A	28	40	48	53
			B	15	9	7	2
			C	6	2	0	0
			D	3	4	0	0
42	.81	.78	A	10	4	0	0
			B	13	6	0	0
			*C	26	41	55	55
			D	2	4	0	0

Item No.	p Value	Point Biserial Correlation		Distractor Effectiveness Low 25%	3rd 25%	2nd 25%	Top 25%
43	.61	.13	A	9	10	5	2
			B	9	7	13	16
			*C	32	31	34	37
			D	3	7	2	0
44	.30	.32	A	3	5	2	1
			*B	13	8	17	28
			C	28	37	33	24
			D	10	4	2	2
45	.69	.75	*A	16	37	47	52
			B	3	1	2	1
			C	24	12	2	2
			D	5	3	0	0
46	.88	.64	A	6	4	1	0
			B	2	0	0	0
			C	9	0	0	0
			*D	36	49	53	55
47	.74	.49	A	13	7	3	2
			B	5	1	2	1
			*C	30	35	46	51
			D	5	10	3	1
48	.81	.73	A	7	1	2	0
			B	9	2	1	0
			C	9	3	2	0
			*D	27	46	49	55
49	.57	.43	*A	18	32	35	41
			B	7	5	7	4
			C	12	4	0	0
			D	12	13	12	9
50	.58	.68	A	20	11	8	2
			B	16	4	2	0
			*C	10	28	37	52
			D	7	10	8	1

Item No.	p Value	Point Biserial Correlation		Distractor Effectiveness Low 25%	3rd 25%	2nd 25%	Top 25%
51	.67	.34	*A	26	35	38	48
			B	6	2	1	4
			C	8	6	2	2
			D	12	10	14	1
52	.62	.51	A	14	8	3	1
			*B	20	28	42	47
			C	7	4	3	1
			D	10	13	7	6
53	.75	.76	*A	19	41	51	54
			B	26	8	3	1
			C	5	4	1	0
			D	2	2	0	0
54	.60	.67	A	10	5	6	1
			B	14	8	1	1
			*C	17	34	46	53
			D	10	6	2	0
55	.71	.40	A	0	1	0	0
			B	5	0	0	0
			C	16	14	11	9
			*D	29	37	43	46
56	.56	.53	A	5	7	4	1
			B	20	18	12	3
			*C	19	20	36	47
			D	6	4	0	2
57	.71	.45	A	5	12	5	5
			B	9	1	0	0
			*C	27	36	46	47
			D	10	1	2	0
58	.68	.62	A	11	9	3	2
			B	10	10	3	4
			C	7	1	0	1
			*D	21	32	49	48

Item No.	p Value	Point Biserial Correlation		Distractor Effectiveness Low 25%	3rd 25%	2nd 25%	Top 25%
59	.50	.43	A	9	10	4	3
			*B	15	25	31	39
			C	18	17	18	10
			D	10	0	2	3
60	.83	.63	A	9	1	0	0
			B	5	5	3	0
			*C	32	44	51	55
			D	5	2	1	0

*Indicates correct answer.